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POLAND

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IT is a great honour and pleasure to address you to-night on a subject which is near to me by the right of my birth. Considering the importance of the present moment in the history of the re-birth of Poland, it is difficult to deal with the subject in a general way, which would probably be more interesting and attractive. So I purposely dispense with an attractiveness which would give to my paper the nature of propaganda, and propose to give you some facts of a geographical and ethnological nature which may help you to form an opinion of modern Poland. I do it the more particularly because Poland and its people have been treated for the last hundred years by the nations who did not partake in the partition merely as a matter for sentiment. In this way those who were Poland's friends as far as larger issues were concerned, have rendered her the worst possible service by never touching realities and putting her in the category of those problems which are too confused to be settled and too nerve-shattering to be contemplated. Hence the facts about Poland were known only to her rivals, and suppressed by them in an ingenious way.

The Great War and the revolutions that followed it have brought the phantom of Poland to the realm of reality—a fact more striking to people abroad than to the Poles, who were living in constant expectation of this miracle. France had its period of preparation for revenge; Poland had its period of patient expectation.

I intend to confine myself to the historical changes affecting the Polish frontiers up to the present day; but in order to make that survey comprehensive, I shall venture to bring to your mind some data relating to the Polish people and land.

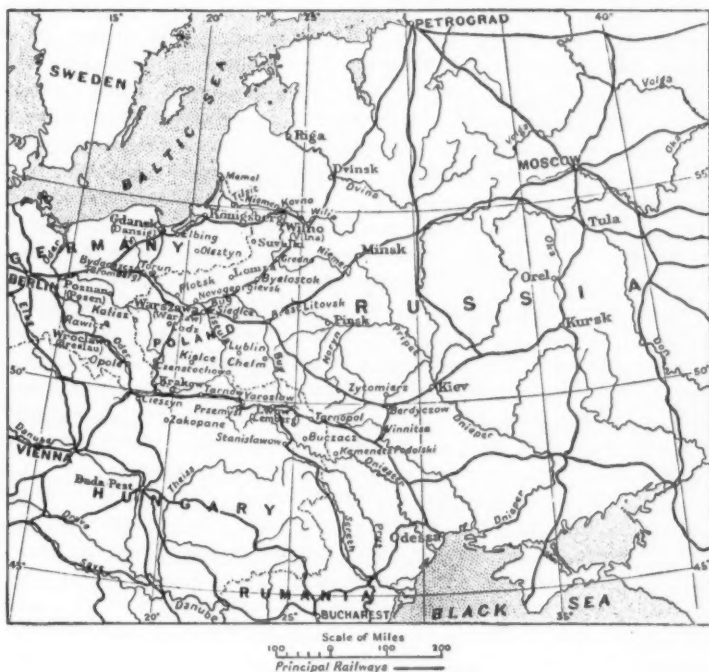
The Poles with the Czechs, Slovaks, and Croats form the western branch of the Slavonic world—a classification based on linguistic evidence and generally accepted. Whatever was the original Slavonic race, its original type has probably persisted most strongly among the Poles and Czechs, since they were the only Slavs who escaped the rule of the Turkish

peoples. The Poles, through their political alliance with Lithuania and the Ukraine, have some admixture of these two strains in their veins, more Lithuanian than Ukrainian, since the Lithuanians, like the Poles, were Roman Catholics. Owing to political rivalry between the Poles and the German world, there is not much German blood in the Polish people. Still, if we consider that after the Tartar wars of the thirteenth century and the devastation of the country, the German and Jewish immigrants were permitted to settle in the towns and some generations later became patriotic Poles, we have to allow for a small German and Jewish admixture also. The second great immigration of Jews, at the beginning of the sixteenth century, came from Germany, and they remained to a great extent unassimilated. By referring to the considerable degree of purity of the Polish race, I want to convey the fact that its biological unity was a predominant factor throughout the history of Poland; in fact, it is the Polish nationality, well marked culturally and linguistically, that defines the Polish country, the country itself having no striking geographical boundaries. Of course it must not be understood that in physical type the Poles form an exception to the general rule which governs Europe, *i.e.* that in the north the fair tall type is predominant; in middle Europe the short darkish; and in the south the tall dark Adriatic type. But Poland does not reach so far south, and has very few of the Adriatic type, and the majority of her people are of the Central European type—otherwise called the Alpine type.

Further, while the form of state organization among the eastern Slavs was introduced by the Scandinavian house of Rurik and united people of Finnish, Slavonic, and Turkish blood, the formation of states among the western Slavs, *i.e.* the Poles and the Czechs, was due to the organizing ability of houses of Slav peasant origin—the Piast in Poland and the Przemyslid in Bohemia. It was the six closely related Slavonic tribes which united in one under the name of Poland in the ninth century, and this union was effected on the territory of the Warta, a tributary of the Oder, which according to the latest archæological researches is the oldest known Slavonic territory. It is also of some importance for the history of Poland that the two missionaries to the Slavs—Cyril and Methodius—as far as is known never reached Poland in their wanderings. Since their cultural efforts, such as the introduction of the Slavonic alphabet, served in some degree to create a bond of unity among the other Slavs, southern and eastern, it is obvious that Poland was not included in this fraternity, and throughout her history the ties of common culture were stronger for her than the ties of similarity of language. Christianity was introduced into Poland from Rome through Bohemia in the tenth century, and the first written character was also Roman. This again made henceforward for a cleavage, cultural as well as racial, which divided her from the eastern Slavs who adopted Christianity from Byzantium. In time the ties with Roman-Latin culture became still

stronger, and in the history of Polish culture Latin played the same role as it did in Western Europe. In fact, even to-day the ancient University of Cracow could outdo Oxford in the amount of Latin demanded for matriculation.

By Western Europe I mean not so much Germany as Roman Italy and still more France; only quite recently Great Britain also. In a way cultural intercourse between Germany and Poland was impossible owing to the circumstance that a generation hardly ever arose without seeing a



Sketch-map of Central Europe

war between them. But the real danger began when the Teutonic Orders, invited by Poland in 1226 to convert the Little Baltic tribe of the Prussians to Christianity, began to increase in power. Some two hundred years later, in the Battle of Grunwald (1410), the Teutonic Order, supported by all the German world, tried its strength with Poland, helped by nearly all Slavdom. Victory at that time was on the side of the Slavs.

The territories of old Poland which were not inhabited originally by Poles were hardly ever acquired by conquest. The territory called now Eastern Galicia was finally included in Poland in 1340, after the death of the last Halich prince. Lithuania was united in 1386 to Poland through

the intermarriage of the royal houses, and then through treaties. And the agricultural Ukraine was also acquired by negotiation. The exception to this tradition was Poland's attitude towards the Cossacks in 1648 in the Southern or Steppe Ukraine. The wars with the Cossacks aimed at subjugating the Steppe Ukraine directly to Poland, instead of leaving it in the autonomous position enjoyed by the Northern Ukraine, and they shattered for the first time the power of the Polish state. Ever since the end of these wars Russia has become Poland's rival in gradually acquiring the Ukrainian lands.

In the inner history of Poland the outstanding features were: The first constitutional act "*Neminem captivabimus*" concerning personal inviolability, which was introduced in 1422-5 and forms a Polish Habeas Corpus Act; and the establishment in 1505, by the statute "*Nihil Novi*," of the regular Diet composed of an elected king, a Senate nominated by the king, and a Chamber of Deputies. Since then the Polish constitution has undergone various changes until its last expression, which was the draft of 1791, between the First and Second Partitions. The present is a further development of the previous constitutions. Thus in the history of Poland from the ninth to the eighteenth centuries the three essential factors are: (a) her defensive attitude towards Germany; (b) her expansion towards the East by conciliatory means, with the exception of the Cossack incident; (c) a development in cultural and especially in political life, greater, if we compare the dates of the Polish *Neminem captivabimus* (1422) and the English Habeas Corpus (1679), than her geographical position would allow us to expect. And all this Poland achieved with no better geographical frontiers in the past than she has at present.

It is difficult to finish this short sketch of the Polish people without referring to the Partitions. Until the recent revolutionary events and the consequent experience that Western Europe has gained by watching them, it was hard for ordinary men to understand that such a powerful state as Poland could have been divided so decisively between the years 1772 and 1815. Of course the Powers who took part in the Partitions, and especially the one that printed the greatest number of books—Prussia—explained to the world that it was owing to the decadence of the Polish race and lack of political sense. As for the decadence of race, the proofs are not forthcoming; and as to the lack of political sense, perhaps all social revolutions can be so called, and it is a fact that Poland was undergoing a social revolution when she was partitioned. Her danger was much greater than that of any of the countries now in revolution because all three of her neighbours were at that moment at the zenith of the opposite régime, i.e. autocratic monarchy.

The effect of the partition was only to strengthen national feeling, and did not at all affect race integrity; and at the beginning of the twentieth century (1910), in the territory of ethnographical Poland, i.e. lands always inhabited by a great majority of Poles, there were, according

to the strictest calculations, over 17,000,000 Poles in an area of some 768,000 square kilometres, while in the territory of historical Poland, *i.e.* Poland as she was before the Partition of 1772, there were over 21,000,000 in an area of 730,752 square kilometres. The grand total, including the Polish colonies in Europe and the two Americas, was over 24,000,000. Since then the population has increased by 2,000,000—an increase too rapid to be accounted for by natural causes, and it can only be concluded that the last census was more carefully taken, or that some people reverted to their Polish nationality.

Let us consider for a moment what the geographical situation of ethnographical Poland is. In the north it is the continuation of the north European plain. The south of Poland is mountainous, and these mountains, the Carpathians, are also the continuation of the central European massif, through the Eastern Alps. One branch of the Carpathians, the Tatra, the height of which reaches in some places 2600 metres, is particularly Polish in language and tradition. A settlement called Zakopane, situated in one of the valleys, plays the rôle of a Mecca in modern Poland, and there all the people of intellect and energy meet for exchange of ideas and plans. Even during the worst political crises this spot has always inspired the thoughts of its frequenters with the idea of freedom. But then, by the Poles, even the dreary monotonous plains of the north were regarded subjectively, and scarcely any literature of the world can equal the Polish in descriptions of the beauty of the country. The flat plains of northern Poland are separated from the Baltic Sea by a lake district. The chief artery of Poland is the River Vistula, rising in the Carpathians in what used to be Austrian Silesia. It runs through the very heart of Poland and falls into the Gulf of Danzig, called by the Poles Gdansk. The area watered by the Vistula and its tributaries extends to 198,000 square kilometres. The distribution of its tributaries is most fortunate and permits of communication with the River Dnieper through the Oginski Canal, with the Niemen through the Augustowski Canal, and with the Oder through the Bromberg Canal, called by the Poles *Bydgoszcz*, but the Vistula is only canalized in the northern part which is under Prussian rule. Of the other big rivers not one runs through purely Polish territory in its whole course. In the west the River Warta, a tributary of the Oder, waters some 84,774 square kilometres of purely Polish territory. In the north-east the Niemen is shared by the Poles and Lithuanians. In the south the tributaries on the right bank of the Dnieper and parts of the Rivers Dniester and Southern Bug also water Polish territory.

The predominant character of the Polish lands is that they are a transition between the east and the west in climatic, botanical, and zoological features. "Poland lies between two areas which differ in regard to both material well-being and culture; between them there exists a strong impulse for exchange, similar to the tendency towards exchange of air under different pressures which gives rise to currents of air" (W.

Nalkowski, 'Poland as a Geographical Entity.' London, 1917, p. 21). Above all it is in the economic and political history of the country that this transitional character and lack of definite natural boundaries to the east and west are seen. Economically this is a favourable feature, especially as Poland has no marshes or deserts difficult of access, and hence presents an ideal trade route. This makes Poland a passage for the carrying trade, while her own export trade is of two kinds: Eastern Poland, like the rest of Eastern Europe, sends her raw materials to the west, while Western Poland passes on her manufactures to Eastern Europe and Asia. This transitional character, however, is less fortunate in time of war, especially in the wars of the past, since modern warfare to some extent disregards natural boundaries. It has been said of almost all the countries of Eastern Europe that they have been the bulwark of civilization by preventing Asiatic invaders from entering Europe; yet it is through her geographical position that Poland unfortunately has deserved this name more than others who were protected by mountains and forests. But the integrity of the Polish race overcame the unfavourable conditions, and while we find in the ideally situated Bohemia two races struggling for predominance, within the limits of ethnographical Poland there is only a small minority of Germans in Prussian Poland and of Ukrainians in Galicia.

I do not hesitate to say that the Polish lands are by nature endowed with something that counts for more than definitely marked boundaries, even though I know that this learned Society numbers among its members some of the most prominent boundary-makers—including such an authority on frontier theories as the President himself. The Polish soil is, in most places, amongst the richest in Europe, and the minerals found in Polish territories include all those that modern industries require. It is to a great extent a self-supporting country, and a country which, even under the difficult rule of the old *régime* of dependence, exported both raw materials and manufactured goods. On the whole modern Poland is still essentially agricultural, though industrial development has been very rapid, and the value of industrial is beginning to equal that of agricultural products. In fact, in the kingdom of Poland in 1910 the value of industrial products reached nearly three milliards of francs, while the agricultural products of the same year were estimated at less than two milliards of francs. In Galicia the two values were almost equal: in Prussian Poland it was in the interest of the Prussian Government to see that industry should not develop in Polish hands. On the other hand, as the agricultural products of the Polish provinces were necessary for Prussia, she did not interfere with that side of Polish activity. The country of Posen attained a remarkable development in that way, and occupied the first position in the Prussian State, owing both to good soil and intensive cultivation. While arable land was only 48·1 per cent. of the total area, in Posen it was 63·7 per cent., and next to Posen stood

Eastern Prussia where the arable land reached 56·6 per cent. In 1913 the provinces of Posen and Eastern Prussia contained 30 sugar refineries, 917 distilleries, and 178 breweries. The development of agriculture all over Poland rested entirely in Polish hands. Three kinds of agricultural societies, those for small properties, those for large properties, and mixed societies, acted in accord all over Poland, and had their headquarters in Warsaw, Cracow, Lemberg, Vilna, and Posen.

The mineral wealth of Poland consists of large coalfields, iron, lead, zinc, copper, and silver. The mining industry dates very far back, and it was already well developed in the fourteenth century at Olkusz, near Cracow, which is rich in zinc, but the earliest is the salt-mining industry. The rock-salt mines of Wieliczka near Cracow were already worked in the eleventh century. Wieliczka presents the almost unique sight of a picturesque underground settlement where everything is cut in salt. The numerous mineral springs are also situated chiefly in Southern Poland, especially at the foot of the Carpathians (Drogoslaw, 'Poland and the Polish Nation,' p. 71. London, 1918). Then comes that valuable earth-product, petroleum, in a region on the northern side of the Carpathians some 365 kilometres in length. The Galician output of petroleum before the war covered the needs of the Austro-Hungarian Empire and allowed for an export which in 1908 was 2·4 million quintals ('Poland.' Edited by Erasmus Piltz, p. 152. London, 1919). It is difficult to make a calculation of the wealth of coal in the Polish lands, because the statistics relating to the Cracow-Silesian basin, the richest of all, and extending into all three divisions of Poland, include purely Polish territories like Dombrowa and the Polish districts in Austrian Silesia as well as the non-Polish or Czech districts of Silesia; but the last estimate of the whole basin is that it contains 94·33 milliards of tons of exploitable coal in an area of 5690 square kilometres. The total output in 1911 was more than 52,000,000 tons, but what is more important to remember is that for the last forty years the output of coal has increased seventeen times in the Kingdom of Poland, eight times in Galicia, and only six times in Upper Silesia, though it was in the last-named that this industry was chiefly in German hands. Yet the production of coal in Russian Poland has been much hampered by the Russian policy of flooding Poland with coal from the Donietz district, which they were able to do by reducing freights to a very low rate. This and the lack of capital is largely responsible for the increase in industrial activity noticeable to the traveller crossing from Russian to German Poland (*Z. Daszynska-Golinska, 'Rozwoj i Samodzielność Gospodarcza Ziem Polskich.'* Warsaw and Cracow, 1915).

Considering its great natural wealth, it is hard to understand why, if Poland has her natural outlet to the sea, some people should still doubt the possibility of her own economic independence, and think that under the Partitions Poland was politically and culturally oppressed, but had at the same time some economic advantages. Was it so? With your

permission I shall devote a few minutes to the economic situation under the Partitions.

In Russian Poland shortly after the Congress of Vienna—which, it must be remembered, guaranteed freedom of commerce between all three parts of Poland as they were in 1770—under the direction of Prince Lubecki, the Polish Minister of Finance and the originator of the Bank of Poland, Polish industry developed rapidly under the favourable conditions of the tariff arrangements of 1822. These materially facilitated Russian Poland's export of manufactured goods to Russia and also the import of raw materials from Russia to the Kingdom of Poland and the other parts of Poland which at that time were not divided by tariffs. But in 1831 new Russian tariffs were imposed which were too obstructive for the young Polish industries. Some manufacturers migrated to Russia, others moved to the outskirts of Poland which were outside the tariff line. In that way the Byelostok industrial centre originated. In 1859 Russia abolished the tariff wall between her and the kingdom, and thus moved the tariff frontier to the western boundaries of the kingdom. Since then all the industries of that part of Poland have developed rapidly, but as an addition to Russian industry, *i.e.* they were not allowed to develop when any Russian industrial undertaking was a rival. On the other hand, high import duties on manufactured goods from abroad and such goods as sugar, alcohol, and beer allowed Poland to develop these industries for export to Russia. Russian Poland from that time till the Great War was steadily losing its position as a corn-exporting country (Russia proving too strong a competitor), but concentrating its efforts on industry and sugar-beet plantations. Since 1894, when Russia imposed prohibitive duties on half-manufactured as well as manufactured goods, Polish industries have suffered to a great extent, being dependent on foreign half-manufactured goods. Poland had to acquire cotton of an inferior quality and higher price from Russia instead of from other countries; coal from Donietz instead of from her own mines; salt from South Russia instead of from Galicia. Whenever there was a conflict of interest between Russian and Polish industries, *e.g.* the textile industries of Lodz and Moscow, the Russian Government favoured, not unnaturally perhaps, their own enterprise. So even though both Russian (Yanchulle) and German (Schultze Gavornitz) economists rate more highly the power of production of the Polish workman than that of the Russian workman, yet in the years preceding the war the Russians began to send to Poland not merely raw products but even textile and other manufactures of lower quality, and Poland had to find markets for her industries further east.

In Prussian Poland the Poles were still more hampered in the choice of their occupation than in Russian Poland. The most profitable occupation under the circumstances in Posen and Eastern and Western Prussia was highly developed agriculture. Only in Upper Silesia did the mining and manufacturing industry develop very highly in the German districts as

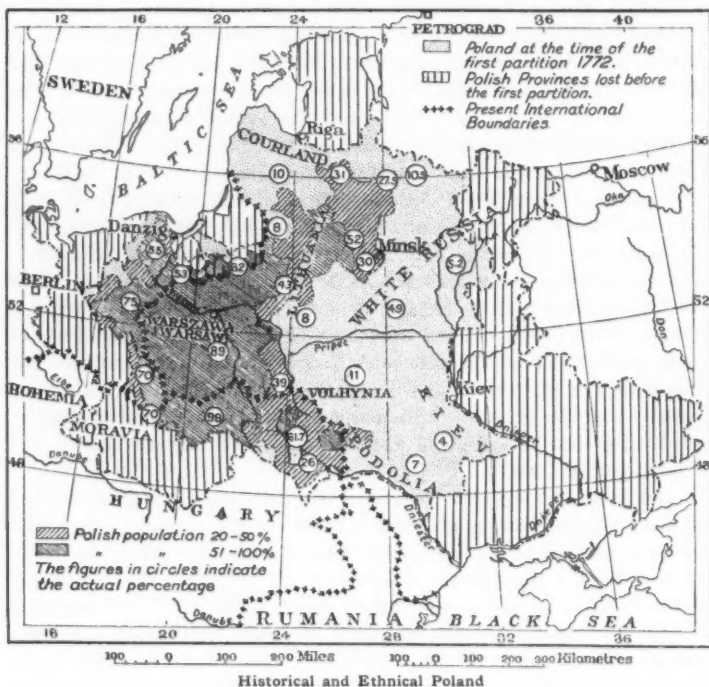
well as the Polish, owing to the immense mineral riches of this region. But German capital was chiefly employed, and consequently the Germans controlled the industry of the district even though Polish engineers and workmen were in a majority in many places. The Prussian Government pursued a policy of boycott of all Polish enterprises, and the high German officials personally carried on a propaganda aiming at the germanization of industry. To this must be added such unconstitutional laws as the Expropriation Act of 1908, according to which any Pole could be forced to sell his land to the Government, and the picture of the difficulties besetting the economic life of Poland is complete.

Austrian Poland, though also possessing minerals essential to local industry, was the most backward part of Poland in this respect. In a way this was merely a direct result of its having been a province of an empire as completely agricultural as Austria. The system of duties made the position of Galicia especially unfavourable. Prices were imposed on Galicia from outside and industries prohibited if they in any way endangered those of other Austrian states. Then railways were built for purely strategical reasons, and disregarding the commercial necessities of the country to a greater extent even than in the kingdom of Poland. The special industries of Galicia have declined since the beginning of the Austrian régime; thus in the time of the independent Duchy of Warsaw the annual output of salt was 2000 tons; but since it has been the property of the Austrian Government, it has produced only 1000 tons per annum (S. Posner, 'Poland as an Independent Economic Unit.' London, 1916). But the greatest restriction on Polish economic development was the fact that Poland could make no use of her natural outlet to the sea, the port of Danzig.

Fortunately enough the boundaries of ethnographical Poland include all those mining districts and arable lands which even under hard social and political conditions assure her a certain amount of export trade.

Now I shall consider the question of the historical changes in the Polish frontiers. First in the east: Eastern Galicia or Chrobatia was, according to the old Slavonic Chronicle of Nestor, captured in the tenth century from the Lakhs or Poles by the Kiev Russ people, ancestors of the Ukrainians and the Russians. It remained mostly under the domination of the Russ princes until in 1340 it passed to Poland by dynastic arrangements, and the Polish King, Casimir the Great, made Lwow (Lemberg) a centre of Polish life in the east. From the middle of the fourteenth century Eastern Galicia remained united to Poland until the Partition of 1772. Galicia as well as Podolia formed an integral part of Poland; that means that they had the Polish law of Wislica, though the majority of the inhabitants were not Poles. Different was the relation of Poland to Volhynia, Kiev and Polesie, lands belonging to Lithuania until the sixteenth century, and which at the Union of Lyublin (1569) joined Poland just before Lithuania, with White Russia, finally did so. These lands, with

Lithuania, stretching as far east as Poltava and as far north as Esthonia, were all governed by the Poles under a law called the Statute of Lithuania, which was a combination of the old customary law of the Eastern Slavs and the Polish Statute of Wislica. It must be remembered that the first union of Lithuania and Poland dated as far back as 1386. In 1667 a line between Great Russian and Polish spheres of influence was fixed at the River Dnieper, but the country of the Lower Dnieper where the Cossacks lived was only partly dependent on Poland from 1572, and was finally conquered by Russia in 1712, when also the independent communities of



the Russian Cossacks were destroyed. In the First and Second Partitions Russia acquired all the eastern lands of historical Poland (here I would like to remind you that by historical Poland I mean all the lands to the east of Galicia), and in the Third, of ethnographical Poland. This, however, did not abolish the position of the Poles in historical Poland. In spite of special restrictions imposed on them, the Poles, all of whom are well educated, form 17 per cent. of the population, and up to 1917 they possessed about 22 per cent. of the property in land and nearly a third of the house property. Their highest percentage is in the Government of Vilna, and in the town of Vilna the great majority are Poles.

It is the racially non-Polish lands of historical Poland which have formed the bone of contention between Poland and Russia throughout their history. But the situation is quite changed now. There can no longer be a question of uniting any part of these lands to Poland or to Russia without the consent of the inhabitants, for during the hundred years which have passed since the re-affirmation of the partition of Poland at the Congress of Vienna, the spirit of national consciousness has developed among those people who once belonged to historical Poland. There are two kinds of national problems in this region. The Lithuanians, who number something between two and two and a half millions and who inhabit the north-eastern part of East Prussia, the northern half of Suwalki, a part of the government of Vilna, and the government of Kovno, are a homogeneous people of one language and of the Roman Catholic religion. At the time when they belonged to Poland their educated classes became polonized, thus forming a kind of Ulster in Lithuania. Many Polish national heroes belonged to this class, to mention only Kosciuszko, the poet Adam Mickiewicz, and the great patriot of the present day, General Pilsudski. But during the last fifty years Lithuania has evolved a new educated class of purely Lithuanian aspirations. They have recently been closely united to their neighbours, a still smaller national group, the Letts, who number under half a million and live in the government of Vitebsk, where they are Roman Catholics, and in Courland, where they are Protestants. They are a well-educated people, and, not unlike the Poles in Posen, have had to oppose socially and economically the large landowners of German nationality who live on their lands. The strength of both the Lithuanians and Letts lies in their unity and integrity, and the fact that national feeling dominates social differences. And the geographical position of the lands of both is similar with regard to the Baltic Sea. If a community of interests should arise between Poland and Letto-Lithuania, there can only be a question of alliance and not of a Polish protectorate.

The national development of the White Russians and the Little Russians, called also Ukrainians, can still be called an unknown quantity. The White Russians, numbering over 6,000,000, chiefly inhabit the Governments of Minsk, Mogilev, and Grodno, and partly that of Vitebsk. They are partly Roman Catholic, and differ from the Great Russians, but have hardly any educated people who are not polonized or russianized; they seem to have very little reason for complete independence, even though racially they form a pure branch of the Eastern Slavs.

Even more difficult is the problem of the Steppe people, the Ukrainians, by which name propaganda literature denotes various peoples living between the Don and the Dniester, speaking mostly Ukrainian dialects, and numbering almost 30,000,000. The national movement originated some fifty years ago with the class of "intelligenza" in Kiev and in Lwow, and it was utilized very soon by both the Russian and Austrian Governments as a weapon to create in each country an Ukrainian irredenta.

Since 1917 the unrest in the Ukraine has been social rather than national, for the educated nationalist leaders could not control the masses, and consequently could not keep their political treaties; so it is difficult to ascertain how far the Ukrainian peasants, who form nine-tenths of the Ukraine, follow the national tendencies of the intelligenzia, who no doubt consider themselves a nationality different from the Great Russians and the Poles. So far a literature written in various Ukrainian dialects and including contributions from several men of great talent, as, for example, Shevchenko, has demonstrated only their separatism. Before the partition of Poland the country of the Ukraine was always treated as a colony by either Lithuania or Poland or Russia, and the educated classes were either polonized or russianized. Now its educated class, Ukrainian in feeling, is more numerous, but the majority of the people are still the most uneducated peasantry of all the lands which used to form the Russian state; at least the last Russian statistics confirm this (Shchegolov, Semenov). The country of these people is quite justly called the granary of Europe, and it is also rich in minerals, so it is very desirable that the social unrest there should be brought to an end. But the settlement of her national demands must be considered as more experimental than is the Letto-Lithuanian settlement, on account of her lack of integrity in race, culture, and language. The Ukraino-Polish conflict, which on the surface looks nearly like a nationalist quarrel, is seen on closer examination to be more a social question; for the Polish minority in the Ukrainian or Ruthenian ethnic lands of Eastern Galicia is in the position of landlords, big business men, and otherwise of masters. Then, though they are in a minority in the country, the Poles and next to them the Jews form a very great majority in the towns of the Western Ukraine, and the Russians and again the Jews play the same *rôle* in the towns of the Eastern Ukraine. However, land is there in plenty, and all local forces are needed to develop its resources, so it is in the economic interests of the country that a compromise should be effected between the Ukrainian claims founded on ethnical grounds and Polish claims founded on historical grounds.

The claim of the Polish minority is quite a different question from the problem of the Ukraino-Polish racial boundary. The opinion of an impartial scientific commission from abroad would no doubt be most useful in settling the matter. At present the propaganda literature of the Ukrainians claims that the River San, a tributary of the Vistula, is the boundary of the Ukrainian linguistic frontier, while the same kind of literature on the Polish side makes the River Horyn, a tributary of the Pripet, such a boundary. One can therefore conclude that the territory between these two, *i.e.*, roughly speaking, between 23° and 27° E. long., will have to be investigated, and the final settlement made in such a way that the Polish minority inhabiting the country for centuries, if cut off from Poland, may have a position corresponding to its historical and cultural importance.

This claim may be classified in the same rank as the claims of the Germans in Eastern Prussia (but comparing these two problems, the Poles seem to have a stronger *raison d'être* in the Ukraine than the Germans in Eastern Prussia). The problem is troublesome for the moment on account of the social unrest and the lack of any state tradition among the Ukrainians, but the line of racial demarcation between the Ukrainians and the Poles is clearer than it is between the Ukrainians and the Great Russians. On the other hand, economically the Poles and the Ukrainians supplement each other.

If the problem of Poland's eastern frontiers cannot be stated very definitely owing to the circumstances of Ukrainian and Russian unrest, and owing to the difficulty of prophesying how the national demands of both will shape themselves after the crisis, the problem is otherwise on Poland's western frontiers.

The national line is there very definite, the historical facts well known, and the minimum economic necessities of Poland on the one hand, and those of Germany and Bohemia on the other, are quite clear. If there is any political difficulty in drawing a boundary-line, it is just because fidelity to the truth makes compromise rather difficult. The so-called German but in reality Prussian Poland must be considered from its historical and ethnological aspects; and I only take the historical because there exists an unbroken line between the past and the present.

The territory of German Poland falls historically into two categories :

1. The territories annexed by Prussia in the Partitions of 1772 and 1793, *i.e.* Posenania, West Prussia, and Warmia, a district of Eastern Prussia. Posen, 1,463,000 Poles and 637,000 Germans; Western Prussia, 754,500 Poles and 949,000 Germans. Total, 54,546 square kilometres (Posen 28,991 square kilometres, and Western Prussia 25,555).

2. The territories which Prussia, or rather Brandenburg, obtained before the Partitions—that is by the Treaties of Wehlau in 1657 and of Breslau in 1742. This consists of the Polish portion of Eastern Prussia which corresponds to the district of Olsztyn (Allenstein), where Poles form 70·9 per cent. of the population; the portion of Pomerania called Butov (Bütow), and Lembork (Lauenberg); also the Polish part of Prussian or Upper Silesia, which corresponds to the district of Oppole (Oppeln), where Poles form 72·7 per cent. of the population: the latter passed under Prussian rule in 1742. The era before the Partitions of Poland has here to be taken into account, as this enables us to discover which of the two races forms the original and permanent element of the country.

The Duchy of Posen is the cradle of the Polish race; its first half-mythical capital Gniezno (Gnesen) is situated there, as well as the first historic capital of Christian Poland, Poznan (Posen). Posen was annexed by Prussia in 1793, at the time of the First Partition of Poland; it belonged again to the independent Duchy of Warsaw in 1807, and was

given anew to Prussia by the Vienna Congress in 1815. In the province of Posen 61.5 per cent. of the population is Polish. The Germans consist chiefly of soldiers and officials. In the town of Posen there were living in 1914 30,000 Germans of a non-official class as against 170,000 Poles. The method by which it was governed by the Prussians is known to every one in Europe, with forcible colonization from 1886 and the Act of Expropriation of 1908. The Prussian Colonization Committee, however, proved impotent even in a material sense against the organized Polish community, and it was in Posen that on 3 December 1918, at a District Congress, representatives of 4,000,000 Poles subjected to Prussia voted for their reunion with the rest of Poland, and expressed a vote of confidence in the representatives of their countrymen at Paris.

Western Prussia, like Poznan, belonged to the Polish crown, and was therefore called Royal Prussia in contradistinction to Eastern Prussia, which was only under Polish suzerainty, and was therefore called Ducal Prussia until 1657, when the Elector of Brandenburg ceased to pay homage to the Polish King. Poland was in a way responsible for this colonization of her provinces by the Germans, but when she invited the Teutonic Order in the thirteenth century she invited them as Christian missionaries, not as German colonists. West Prussia passed to the Germans at the Partition of Poland, but it must be remembered that before then also it was partly colonized by the Germans, who were thus under Polish rule until the Partition. The Partition of 1772 separated Danzig from Poland, and although Danzig belonged to Poland until 1793, Frederick II. did everything to ruin it materially and to break in that way the resistance of the inhabitants who wished to belong to Poland. Heavy import duties were introduced, which made trade with the interior of Poland impossible, and railways were built in such a way that all exports from Poland were directed to the purely German ports of Hamburg and Bremen. It is worth mentioning that Danzig at the time when it made an armed resistance to the Prussian domination after the Partition of 1793, had as now a large German element; but this element was of the type found in free port towns—a type which cares for independence in itself; the town never had any political restrictions under its Polish rulers. Danzig was only once in German hands previous to the Partition, for about 150 years in the fourteenth century (1308–1454). But it was at a later period—from 1454 to 1795, when it belonged to Poland—that its glory was at its height. There are ample proofs showing that the old Germans of Danzig friendly to Poland were diminishing in numbers, and that their ranks were being filled by Prussian officials and official colonists; for the German colonies in Southern Russia (which is now called the Ukraine) and on the Volga were largely composed of the purely German families of Danzig who became bankrupt at home as a result of the anti-Polish policy of the Prussian Government.

In the Regency of Danzig composed of twelve districts the Poles

number 67.7 per cent., but in the district and town of Danzig they are in a small minority. The Polish population outside Posen forms at present a majority in fourteen out of twenty-seven districts of Western Prussia, and in four other districts it forms 44 to 50 per cent. In spite of all its efforts, the Prussian Government did not succeed in exterminating the Polish population on the upper reaches of the Vistula, the Polish districts of Puck (Putzig) and Wejherowo (Neustadt) thus make a Polish ethnic line stretching all the way to the sea. But it has succeeded recently in breaking the ethnographical continuity of the Poles along the left bank of the Vistula for about 30 kilometres, and along the right bank for about 60 kilometres. German colonists were thus settled to the number of 420,000. The question now is to determine in what degree the element recently and forcibly transplanted should count in ethnographical calculations, and if these 400,000 colonists should stand in the way of the real, *i.e.* the economic independence of some twenty million Poles who live all along the Vistula from its sources to its mouth. In Eastern Prussia the Poles are in the majority in the southern district of Olstyn (Allenstein), where some 286,000 of them live. Thus in West and East Prussia, as well as in Oppole of Upper Silesia, the Polish districts form a continuation of ethnographical Poland, and in no way cut off any Germany majority except in two districts of Eastern Prussia, Königsberg and Gumbinnen, where the Poles are in the minority. The situation of this group of Germans is similar to that of other German colonies in the Baltic provinces, and their historical tradition is not as old as that of the Germans in Transylvania and Bohemia. But all these colonies are *not* ethnographically and historically a continuation of their own home country. In the sphere of economics Eastern Prussia is essentially agricultural, and hence was treated by Germany as a colony supplying Prussia with cereals just as Posen was treated, and as all Poland may be treated if she is not mistress of her export trade by sea.

Only a few words remain to be said about the south-western frontier of Poland, where, as you have heard recently, there has been a Czecho-Polish conflict. Austrian Silesia includes the province of Troppau, which is German by character, and the province of Cieszyn with a great Polish majority. It has been ruled for some time by Bohemian and Austrian dynasties, but nevertheless the fact remains that out of four districts of Cieszyn, three, namely Cieszyn, Bielsk, and Frysztat, contain 69 per cent. of Poles and only 11 per cent. Czechs, and one district, Frydek, has a Czech majority. The Allied Commission, with the approval of both parties, put a stop to the hostilities. Possibly some further concessions by the Poles and Czechs will be made in the direction of allowing both new states to develop their industries.

Summing up what I have said: ethnographical and economic Poland can be defined by a figure formed by lines drawn from Vilna to Lwow, Lwow to Cieszyn, Cieszyn to Poznan, and Poznan to Gdansk. The line

between Gdansk (Danzig) and Vilna is concave to allow for the German majority in Eastern Prussia. Poland represented by such a geometrical figure will have fewer foreign elements, not counting the Jews, than any of the other re-created countries in the Near East, but some minorities will unavoidably have to be included, just as some Polish minorities will be included in the states of Poland's neighbours.

Such are the facts based, as far as numbers go, on the official statistics of the empires which divided Poland. The Prussian statistics are of two kinds: those to be found in the *Almanach de Gotha*; the others, the so-called School statistics, which are nearer the true state of affairs. The statistics of the recent Polish Congress in Posen have proved that the second source is fairly reliable.

The three partitioning Powers are to-day shattered to their roots, and economically Poland is shattered still more, for she was merely the step-daughter of these three Empires; but the moral strength derived from the knowledge of liberation is so great that it will probably carry her through the serious crisis of to-day until she is able to obtain direct contact with the Powers to whom she owes her deliverance.

Before the paper the CHAIRMAN (Mr. DOUGLAS FRESHFIELD) said: We are fortunate to-night—and I see by the size of the audience that the Fellows have appreciated their good fortune—in having the privilege of listening to a lecture on one of the many subjects which is of most burning interest in Europe at the present moment—the geographical relations of Poland. We are equally fortunate in the lady who is here to lecture to us. Miss Czaplicka is now established at Oxford. She came to England some eight years ago as a student with a travelling studentship from the Polish Institution of Miancoski at Warsaw. She has since been a travelling scholar of Somerville College at Oxford, is an honorary member of Lady Margaret Hall, and is also lecturer in Ethnology to the School of Anthropology, Oxford. There is no one, therefore, who can speak with more knowledge on matters connected with Poland. Further, Miss Czaplicka has been a very considerable traveller. She has spent a year and a half in ethnological research in Siberia, the results of which she published in two well-known books. I will now ask Miss Czaplicka to commence her lecture.

(Miss Czaplicka then read the paper printed above, and a discussion followed.)

The CHAIRMAN: I will ask Count Zóltowski, who represents at the present moment the Polish National Government in London, to address the meeting.

Count ZÓLTOWSKI: I am extremely thankful to you for the honour of permitting me to make a few remarks before this learned Society. It is indeed difficult, after the learned lecture we have just heard, to tell you much more about Poland that concerns and would be of interest to a geographical society. Allow me to place before you a few remarks concerning the industrial and commercial geography, in giving you a general view of the prospects of economical developments Poland can attain. It has been a rich and prosperous country in the past, large stretches of woodland and fertile soil yielded quantities of corn, timber and potash gained by the burning of timber, and these were exported through Danzig by sea to Holland and England.

The salt trade was one of the most flourishing and important done with the East. The natural riches of the soil are there at present, as they were in the past. The development of agriculture was already in a high condition before the war in the former German part of Poland, where the German government encouraged it, on account of that part of the country being the chief source of supply of food for western Germany. We have every reason to hope that in the former Russian and Austrian parts intense agricultural exploitation will soon equal the production of Posnanian and West Prussia. This has not been possible until now, because the governments of Petrograd and Vienna did not take a favourable view as regards economical development of their Polish subjects. The following figures will give you a good illustration :

Prussian Poland had 15 miles of railroad per 100 square miles.

Galician had 8 " " " "

Russian Poland had 4 " " " "

No wonder that the output per acre hardly attained half of what the German part could reap.

Sugar, starch, spirits, cattle, pigs, fowls, eggs, cheese and butter were exported from all these parts of Poland in large quantities before the war, as well as hemp, hides, horses, etc. These quantities can be increased by some fifty per cent. in the future without any difficulty. The large forests produce timber of all the European varieties, which are not only sufficient for the wants of the country, but which allow us to export a certain amount of timber and its products, paper, cellulose, etc. The output of these can also be increased considerably in the former Russian Poland by abolishing the Russian legislation, which harmed and retarded scientific exploitation.

Poland has a comparatively dense and hard-working population almost like Belgium ; it has also extensive mineral riches : coal, petroleum, salt, potash and metal ores ; the conditions for a strong development of the industry could not be better. But here my previous remarks on the small favour with which our economical development was regarded by the enemy governments applies even more strongly. I will give only one characteristic example. When about the middle of the nineteenth century efforts were made in Galicia to develop industry, the Austrian government issued a decree which forced the factories to send their goods to Vienna to be stamped by the fiscal authorities, and then only could they be returned to Galicia for sale.

Notwithstanding the difficulties created, many industrial branches attained a fine prosperity ; I will mention only the textile factories in Russian Poland and the mining district in Silesia. But on the whole one must state the fact, that the industry of Poland is but commencing, and that the removal of the artificial obstacles will prompt a high degree of activity in this domain, allowing us to export our main products.

This is the situation of Poland and its prospects for the future. They are no doubt good and promising, but I am obliged to add one remark to complete the sketch and put it in the right light. Poland at present can be compared to the owner of a fine estate with good soil and coal-mining prospects, but who possesses neither tools nor sufficient food and clothing to live on, until he can obtain the produce of his property. The war and the German have deprived us of these implements and commodities to a vast extent. One of the chief conditions for giving us the possibility of development of Poland's natural resources is of course the possession of Danzig as an outlet to the outer world. Without this primary condition, Poland would fall utterly under Germany's economical control.

The CHAIRMAN: Will M. Majdewicz, President of the Union of Polish Societies, kindly address us?

Mons. MAJDEWICZ (President of the Union of Polish Societies and of the Polish Information Committee): I have much pleasure in responding to your invitation, Mr. President, to say a few words on this evening's subject. The lecturer has given you such a complete and detailed account of Poland and the previous speaker has so fully supplemented it, that there is very little for me to add. First of all, however, may I be permitted to thank you, Mr. President, and the members of the Royal Geographical Society for the opportunity given to the lecturer of addressing you on Poland. It is a very remarkable sign of the times that England at last realizes the importance of Poland in the future destiny of Europe. Another remarkable proof of that can be found in the fact that whereas in the years preceding the war one hardly found any reference to Poland in the papers, to-day one has only to open a paper, to whichever party it may belong, to find whole columns with regard to Poland and the solution of Poland's difficulties. Many of those paragraphs are very well informed; many are mediocre, and some, I am very sorry to say, are even misleading.

If I may supplement the remarks of the lecturer, I would rather give you a short sketch of the development of the idea of independence in Poland which has occurred in the period since the outbreak of the war up to the present day. As you are very well aware, before the outbreak of the war Poland was divided between three powers: Germany, Austria and Russia. I do not want to enter into details with regard to the persecution and all the oppression Poland has suffered, especially from Germany and Russia, because it would carry me too far, and besides I would not know to which of the two last-named Powers I ought to award the palm of oppression and persecution. If I may compare one to the other, I would say it is six of one and half a dozen of the other. But it is a very remarkable fact that very soon after the declaration of war the three Powers who had ruled—or rather misruled—Poland separately issued a manifesto to the Poles promising to give them—and there is a great difference between promising to give and the actual giving—a kind of autonomy for the future. It was a sort of flirtation to bring the Poles to their side, but I think the Poles were a little too old and cute to be overcome by that kind of flirtation. They wanted more than they could obtain from either of these Powers. Then came the defeat of Russia and the entry of Germany into Poland. From that time onwards a sort of Polish organization has been formed by the means of which the Poles were able to obtain from the Germans some kind of concessions, and that finally led to the proclamation of Independence of Poland on the 5th September 1916.

The Poles had to fight hard for every inch of the privileges they got out of Germany. It was really an independence in name only, without great value whatsoever, but, considering all the circumstances, it was the best obtainable for the moment, and the establishing of the Regency Council was a foundation stone laid, for the future administration of the independence of Poland.

The next step was the collapse of the Austrian Empire, followed by that of the German Empire, and finally the signing of the armistice, which gave Poland an entirely independent government composed solely of Poles. At that time the Regency Council was dissolved and the supreme power was placed in the hands of General Pilsudski, the only man who enjoyed the general confidence of all classes of the Polish community. He carried this

difficult task under very onerous conditions, and we may say in justice that the present order reigning in Poland is chiefly due to his work. Unfortunately the Allied Powers would not recognize Poland or the Polish Government, having previously accepted certain obligations towards a rather reactionary Polish fraction.

And here General Pilsudski, with his great foresight and patriotic self-denial realizing that an early recognition by the Entente Powers is very important for the future of Poland, rose to the occasion, and acting in unity with Paderewski, who was a very popular man abroad, helped to form the Coalition Government which at the present moment is in being, and is at last recognized by the Allied Governments as the proper Government in Poland.

Now that the Allied Governments have recognized Poland as an independent unit, the only thing to be settled is the frontiers, and last, but not least, the very burning question with regard to Danzig. In some part of the press I have seen the view expressed that the claims put forward with regard to Danzig are only paradoxical claims and mostly put forward by the two Polish representatives in Paris, namely, Dmowski and Paderewski, and that the bulk of the nation does not care a scrap whether the Poles have Danzig or not. This is misleading and not true. Although the Poles may politically differ from Dmowski or Paderewski, the whole nation stands united behind them in this claim to Danzig. Danzig is quite vital and essential to the life and prosperity of Poland in the future. It is as if you had taken a limb away from the body. The body may live, but the full energy has gone; it is crippled. You do not want a re-born land such as Poland to be crippled in its infancy. As regards Danzig I will only conclude in the words of a very well-known soap advertisement: "We won't be happy till we get it."

There is one more point to which I want to refer. I am very sorry to say that the English as well as the Allied Press speak of Poland rather contemptuously as a little contemptible State on an equal with Serbia, Bulgaria, Montenegro, and so on. It sometimes reminds me of the utterance of the Kaiser with regard to the English Army as being a contemptible little army. But this contemptible little army grew to a very important and strong one, a very strong one indeed, with which the enemy had to reckon. Thus Poland, once settled down to work, united and independent, will form a very strong and powerful State. It ranks with Italy as the fifth state in Europe, with a population of about 35,000,000. Surely that cannot be called a contemptible little State. It will become very powerful indeed, and form a very important asset in the future League of Nations. One thing the Poles will bring with them, and that is the experience of hundreds of years of oppression and persecution. We have often heard it said that Poland is a fighting nation; that we have fought about a hundred and one wars. This may be true, but there is not a single war which the Poles have carried on that was aggressive. They have always fought only in defence, or for the liberty and freedom of other peoples. And as our forefathers have laid down their lives for the freedom and liberty of other people, so, I am sure, the younger and future generation of Poland will work heart and soul for the benefit of the League of Nations. They will put their whole energy into the future of the League, so that it may become one day a strong, effective, and sincere brotherhood of nations.

The CHAIRMAN: I am sorry we have no one among our own Fellows here, no Englishman, who can speak from knowledge, either personal or literary, of Poland. I must therefore perform the usual duty of a Chairman

and wind up the meeting by asking you to do what I am sure you will do very readily, that is to tender your hearty thanks to the lecturer who has given us to-night so many illuminating facts with regard to her own country, and also to the Polish gentlemen who have followed and have put eloquently before us their, I think we shall all agree, reasonable national aspirations.

It is impossible, particularly when one has not had the privilege of reading the paper beforehand, to discuss in any detail the mass of facts, geographical, historical, and commercial, which have been put before us to-night with regard to Poland. But there are one or two broad aspects which have struck me. We talk nowadays a great deal about the definition of frontiers. There are military frontiers, there are natural frontiers, and there are racial frontiers; and it seems to me that racial frontiers are going to win the day. Military frontiers, we trust—they were always more or less artificial—may eventually be got rid of through the League of Nations. Natural frontiers are very good things in their way. When I was a boy there were two terms which were geographical expressions* of no political import: one Italy, and the other Poland. Now we have lived to see Italy carried up to her natural frontiers—and we trust she will be content to remain within them; and we have seen Poland, a country which is on many sides at any rate almost devoid of natural frontiers, recreated by the strength of national spirit; and apparently, despite the hundred years during which Poland has been split up, this vivid national feeling has so survived that at the very first opportunity the country can spring to a new birth. Here we have a most striking example of what can be done by the human spirit in constituting a state without the help of natural frontiers. We must all hope that Poland will not only have her rightful territory inland, but be able to obtain adequate access to the sea. It is perfectly obvious that it is no good having good wine in the bottle if the bottle is corked up. It appears to most of us, I think, that Danzig is the natural funnel through which Poland should come in contact with the sea; at any rate we must trust that some proper funnel will be found. I think we may also feel to-night some pity for four men who are being very much attacked in the Press: the so-called Great Four. When we consider the mass of detail there is to be studied before deciding what the proper frontiers of Poland are to be, and reflect that this is only one of some dozens of problems before the Congress, we shall probably agree that we must not be too impatient of delays. I will add but a few more words. The name of Poland has hitherto been chiefly associated in our minds with artistic eminence, and it gave many of us a thrill when we heard that Monsieur Paderewski had become the President. I am very glad to learn from our Polish guests to-night that he has been so far successful in his new career, and that there is every hope that he may help in guiding the new State by the help of his extraordinarily sympathetic personality to the position of one of the great Powers in Europe, which we have had put before us to-night as within its possible attainment. I will ask you to tender your hearty thanks to Miss Czaplicka for the very interesting lecture she has delivered.

The PRESIDENT (who was prevented by illness from presiding at the meeting, sends the following contribution to the discussion):

I regard Miss Czaplicka's address as a most valuable contribution to the popular knowledge of Poland at this juncture. But it is an address which is so full of detail that it will require far more careful study than can be accorded to it in the course of an evening meeting. Poland furnishes us with a most useful example of the geographical issues which beset the formation of independent

nationalities. Amongst the many problems which face the Peace Conference that of Poland must be one of the most perplexing, for the great political purpose of an independent Poland in the world's economy is to place a definite limit to the extension of Teutonic influence eastward. To make such a position effective Poland should possess strong natural boundaries applicable to defensive purposes both east and west. Her flanks north and south should be well protected. The geographical conditions which are essential to her own development and prosperity should be secured, and her integrity guaranteed not only by the greater Powers outside, but by an effective army inside her borders. The possible realization of all these ideals is a geographical problem of great importance to those who deal with international boundaries. There was a time in the long past when Poland, which geographically is only a part of the immense lowland which not only extends from Bohemia eastwards into the central plains of European Russia, but which covers the best part of Northern Asia, and, in as far as it reaches the Pacific, really was self-contained within reasonably sound frontiers. That was when she included Bohemia on one side and Lithuania (stretching from the Baltic to the Black Sea) on the other, but those days have long passed, and the Poland of recent history has practically no good national frontier whatever. On all sides she has been enveloped by more powerful neighbours, who have found little difficulty in dealing with her flat river-streaked borders, and who have invaded her territories in ever-increasing numbers both by peaceful penetration and by force of arms. The result has been that there is great difficulty in drawing a line of national boundaries that can make a rigid separation between racial interests around Poland. Indeed, it has been proved to be quite impossible, and advocates of a purely racial basis for the reconstruction of nationalities must admit that as regards Poland at least, the sooner the racial ideal, however necessary to keep it in mind, gives way to the geographical the better. Even in the new Poland no strong geographical frontiers are possible either east or west. Nature has denied them; but north and south at least the Baltic Sea and the mountains of Galicia can protect her flanks and add something to her security.

One geographical necessity for the well-being of the reconstituted nationalities has already proved a stumbling-block to settlement in other countries besides Poland, and that is the necessity for an open port for trade and commerce. So much difficulty has this necessity aroused (and will further arouse) that there has arisen the demand for a new form of geographical definition called the "corridor." Are we going to accept that term permanently? and what exactly is a corridor? It appears to mean an international right of way for commerce to an open seaport; that is to say, a right of way safeguarded by international agreement amongst the great Powers which will enable a landlocked country to reach the sea. This is apparently the solution of the Polish problem as regards Danzig. It may prove the solution of similar problems as regards Fiume or Salonika in the Yugo-Slav interests, or of the Dardanelles in much wider interests. I take it that the three great canal systems of Panama, Suez, and Kiel may all be accepted as sea corridors, but I sincerely hope that geographers will set to work to find some better name for a feature which is not really new, but which seems to be effective enough so long as the guarantors agree amongst themselves.

MAPPING FROM AIR PHOTOGRAPHS

Lieut.-Col. M. N. MacLeod, D.S.O., R.E.

Read at the Afternoon Meeting of the Society, 17 March 1919.

AMONGST the many innovations which the war has produced, not the least interesting and important are the methods of survey and mapping which were introduced and developed in France to meet the needs of the fighting troops for accurate large-scale maps. These needs were consequent on the peculiar character of the fighting, and were not foreseen before the war. That they could be met at all was due to the aeroplane photograph, which was developed and exploited to such an extent that it is no exaggeration to say that the aeroplane camera became the strongest weapon of the "Intelligence" Staff and the topographer. Regarded thus, the aeroplane photograph can be considered in two aspects, one purely "Intelligence," and the other topographical. From the strictly intelligence point of view, its primary function is to show what is on the ground at any moment, so that the intelligence officer, by studying successive photographs and thus watching the enemy's organizations, their nature, change, and development, is enabled to detect and forecast his military plan. Viewed from this standpoint the "interpretation" of air photographs becomes of prime importance, and has become in itself a special study of great interest. From the topographical aspect, however, the function of the air photograph is not to show primarily *what* an object is, but to show *where* it is, and enable us to place it in its correct position on the map. It is with this latter aspect that I have been principally concerned and propose to speak to-day; the two subjects however cannot be entirely separated, and the map-maker must of course always devote considerable attention, at any rate in war, to the correct interpretation of the photographs he uses. In point of actual fact, I think I am correct in saying that the interpretation of photographs as a special study followed some time after their application to mapping, and followed upon the elaborate organization of "camouflage" by both sides. At first, that is in 1915 and 1916, little organized effort was devoted to concealment from the air, the interpretation of photographs was comparatively simple, and their study was directed almost exclusively to correcting our maps and plotting thereon the enemy's and our own trenches and other defensive works.

As stated above, the need for large-scale maps had not been foreseen before the war, consequently the first aeroplane photographs, taken early in 1915, found us without any proper organization for making use of them. Attempts were made by the Intelligence Branch of the General Staff to correct the then very imperfect maps from them; but without success, for the reason that, though the photographs showed all the principal

topographical features in great detail, there was no means of determining their exact scale or the amount of distortion due to the camera not being truly vertical at the moment of exposure of the plate.

This difficulty can be overcome in two ways: one by the invention of mechanical devices for measuring the tilt of the camera and its height at the moment of exposure, and the other by determining on the ground the correct positions of a sufficient number of points which can be identified on the photographs and deducing the scale and distortion of each photograph by comparing the relative positions of such fixed points as appear on it with their true relative positions as fixed on the ground. In France we devoted little attention to the first, and all the methods of plotting we used postulated a sufficient number of fixed points, determined on the ground, or by some independent means, which formed the framework of the map. How this framework was provided has already been described to the Society by Col. Winterbotham, and I will not therefore say much about it. The enemy however, I think, almost certainly employed some mechanical device for measuring the amount of tilt. They also, I think, mark on their photographs the focal length of the lens used and the height at which the photograph was taken. I do not, however, know anything about these devices, and must therefore confine myself to describing the methods of plotting used by ourselves and the French, and such German methods as have come to our knowledge from captured documents.

On any air photograph of a country like France or England the most conspicuous features are the roads, railways, and rivers; consequently to plot a photograph by comparison with a framework it is best that the framework should be formed of these features. In France this framework was provided either from the "Cadastre" or by a plane-table survey (when possible) of all the principal cross-roads, sometimes by a combination of the two. This framework was drawn out on a sheet of paper known as the "compilation diagram," and the first method of plotting used by us to fill in the detail depended on the fixation of a number of additional points by a system of prolongations and alignments depending on the principle of perspective that straight lines on the ground remain straight lines on the photograph, and on the use of proportional dividers for filling in the intervening detail. Corresponding points on the diagram and the photograph having been selected, the dividers were set by trial and error so that one end gave the distance between two points on the photograph, and the other end gave the distance between the same two on the diagram. The detail round them was then plotted point by point by measurement from these two fixed points, checked if possible from a third.

This method was naturally very laborious and slow, and was only accurate when the photograph was taken truly vertical, and the scale therefore uniform all over. This was rarely the case, and it was often necessary

to plot as many points as possible from several photographs to find "mean" positions, and regard these as "ruling" points before proceeding with the plotting of the others. The results, when time permitted, were more satisfactory than one might have expected, but the process was slow, and it was not long before efforts were made to devise something better.

The next development was the use of the "camera lucida" to project the image of the photograph down on to an adjustable board carrying a tracing of the map framework, which could then be swung about until the "fixed" points on the photograph coincided with those on the map framework, when the draftsman could draw in anything on the photograph by running over the lines with a pencil. This method was, and is still, I believe, largely used by the French, who used an apparatus known as the "chambre claire," consisting of a prism mounted over a board carried on a universal joint, the whole being carried on a horizontal slide at the other end of which is a vertical board to which the photograph is pinned. The photograph board can be moved backwards and forwards along the slide by a screw worked from the draftsman's end.

This arrangement was tried by us, but was not found very satisfactory. The strain on the eye is very great, there is considerable parallax and the adjustment is not very easy, particularly if the draftsman does not thoroughly understand the principles of focus and perspective on which the correct adjustment is based. The photographs moreover require treatment before they can be used, or the image on the paper is not sufficiently clear. The French commonly scraped out the roads on the photographs to make them appear bright white, and inked up the trenches in red and blue. I do not like the instrument, at any rate our instrument, for mapping work, as the strain on the eye is so great that the draftsman is often tempted to trace in only a few features and sketch in the rest by eye.

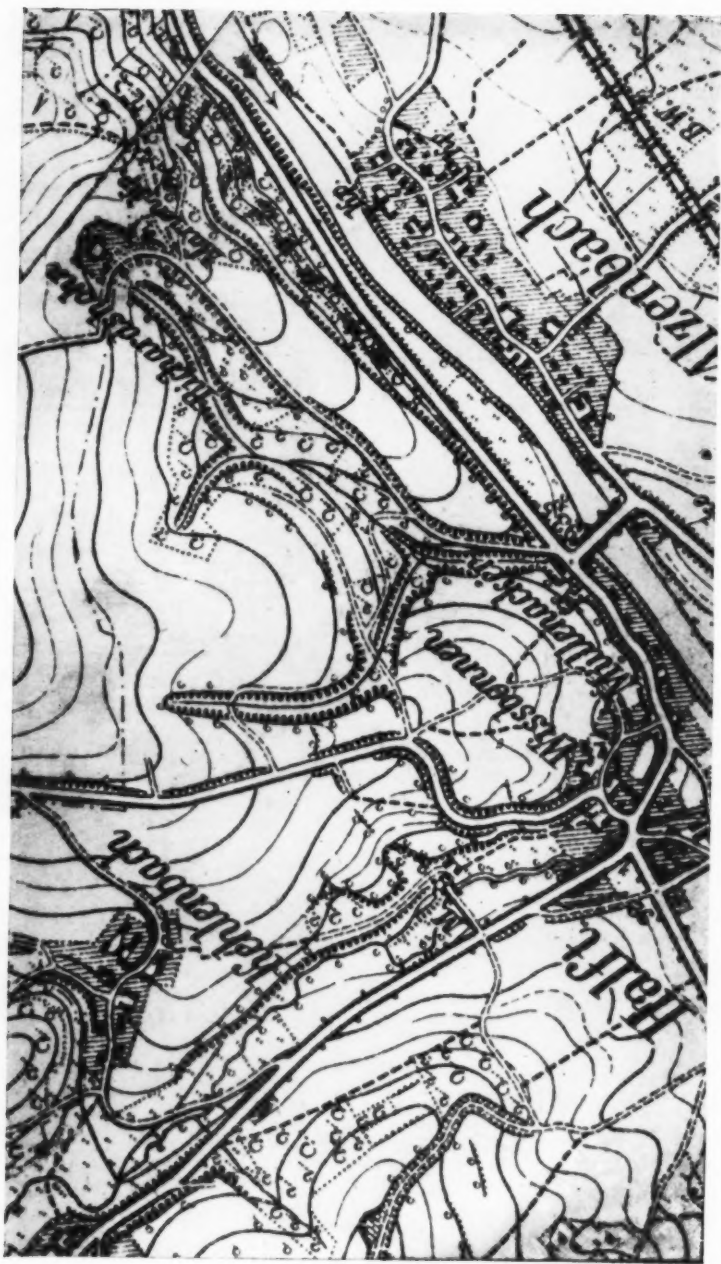
The next apparatus evolved was a cumbersome affair called a "projectograph" constructed by the British. In this the image of the photograph was projected by means of a lens and prism down on to a board similarly mounted horizontally on a universal joint, the arrangement being generally similar to the "chambre claire" of the French, except that the small prism of the "camera lucida" to which the eye is placed was replaced by a lens and a prism which could be focussed to give an image on the board. The apparatus was extraordinarily cumbersome and suffered from the defect that the vertical photograph board could not be adjusted by the draftsman without moving away from the end where he could see the image. The whole also had to be enclosed in a black shroud to keep out the light. Each Field Survey Battalion was supplied with one of these outfits. I eventually made good use of mine, but only after disintegrating it into its component parts.



MAP FOR REVISION BY PLANE-TABLE AND AIR PHOTOGRAPH



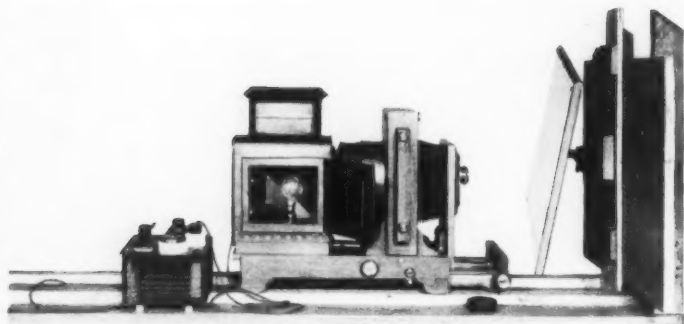
CROSS-ROADS AND CONTOURS REVISED ON PLANE-TABLE: DETAIL TO BE FITTED FROM AIR PHOTOGRAPHS



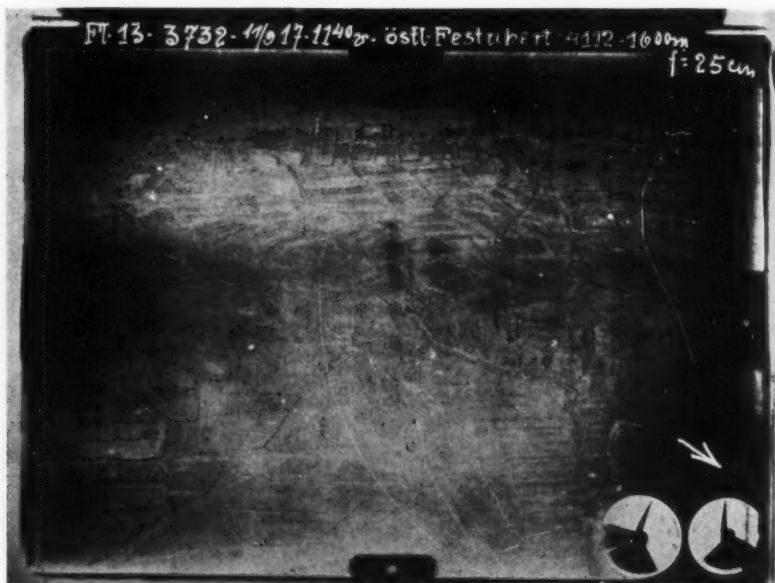
ENLARGEMENT FROM GERMAN 1/25,000 OF GROUND PHOTOGRAPHED OPPOSITE



AIR PHOTOGRAPH OF GROUND COVERED BY MAP OPPOSITE: THE CULTIVATION LINES (WHICH HAVE BEEN STRENGTHENED IN THE REPRODUCTION) SHOW THE TREND OF THE CONTOURS



ENLARGING LANTERN AND TILTING COPYING BOARD FOR RECTIFICATION OF AIR PHOTOGRAPHS



GERMAN AIR PHOTOGRAPH (OBLIQUE) WITH INDICATORS FOR TILT

On the original print it can be seen that the left-hand dial reads about 26 on a scale graduated 0 to 90; the right-hand dial about 2 R. on a scale graduated to 30 R. and L.

In both this and the "chambre claire" I always found great difficulty in adjusting the photograph and the "map" so that the image of the two coincided all over the photograph. The reason may have been that we had not a lens of the proper focal length, a point to which I will refer again later. In any case, it was this difficulty which was the deciding factor in leading us on to the apparatus we eventually constructed, which involved the use of an enlarging camera, and for which many parts of the dismembered "projectograph" came in very useful. Having first prepared the "compilation diagram," the photograph was compared with it and the points common to both, usually cross-roads, but sometimes churches or buildings, were marked on the photograph. The negative was then borrowed from the R.A.F., these points marked on the back of it, and joined up with fine black lines. From the compilation diagram a trace was made of the corresponding figure. The negative was then put into the camera and the image thrown on to a copying board mounted vertically on a universal joint. By moving the board backwards and forwards and twisting it about, the image was adjusted to fit the diagram as closely as possible. Provided the photograph was somewhere near the vertical, as most of those which we used for mapping were, the adjustment was not very difficult. A piece of sensitized paper was then pinned on the board and a print taken. From this print the map detail was traced on to the fair drawing.

To adjust the image correctly at least four fixed points are necessary on each photograph, and these should be of course in the same plane or as nearly so as possible. No adjustment in a camera will correct distortion due to difference of level on the Earth's surface. No amount of juggling with the negative or the board, for example, will make a vertical wall, photographed from an angle and appearing as a narrow oblong on the negative, appear as a Euclidean line on the final print.

The adjustment of the image also depends on the focal length of the lens used in the enlarging lantern.

For correct adjustment the focal length (g) required is given by the equation

$$g = \frac{tf}{p+t} \text{ (assuming that the lens is correctly centred)}$$

where f = the focal length of the aeroplane camera,

p is the scale of the negative,

t is the scale of the map.

It will be seen that when p and t are equal the focal length of the lens used in the enlarging lantern should be half that of the aeroplane camera lens.

In practice it is not possible to use a different lens for every variation of p and f , and it can be shown that correct adjustment can be obtained with a lens of any focal length by using a "rising front" in the enlarging

lantern and displacing the lens a certain distance from the perpendicular to the centre of negative.*

The proof of this is rather too long to give here, as are the calculations giving the amount of this displacement and the inclination which must be given to the copying board.

The latter is given by the equation

$$\sin \phi = \frac{g(p+t)}{ft} \sin \theta$$

where ϕ is the inclination of the copying board to the vertical, the projection of the horizontal line through the centre of the aeroplane photograph being taken as axis, and θ is the inclination of the negative to the horizontal (*i.e.* the tilt).

The displacement, which must be in a direction at right angles to this same axis, is given by the equation

$$d = \left(g \cdot \frac{p+t}{t} - f \right) \tan \frac{\phi + \theta}{2}$$

When θ is small (less than 4°), and p and t are nearly equal, then, if we use in the enlarging lantern a lens of the same focal length as that of the aeroplane camera, we have

$$\phi = 2\theta \quad \text{and} \quad d = f \tan \frac{3\theta}{2}$$

Or, to take a concrete example, if $\theta = 4^\circ$

$$\phi = 8^\circ \quad \text{and} \quad d = \frac{f}{10} \text{ nearly}$$

The final print is rarely clear enough to trace directly on to the fair drawing, and it is generally necessary to ink up such features as have to appear on the map in vermilion, or other suitable colour. This, however, does not take long, and can be done by comparatively unskilled men.

This method proved far the quickest of any we used, and also the most accurate. It has the further very great advantage that every feature, however small, visible on the photograph can be drawn in without difficulty on the map correctly to scale in its correct position. It is, for example, perfectly easy to draw in every individual tree in an orchard or along a road exactly in its correct position. The print is also a permanent record which can be filed with the other mapping material for future reference, if required.

Used in this way the air photograph can hardly be improved on as a means of making large-scale maps. In 1918, after we got this apparatus into satisfactory working order, my Battalion mapped more than twenty 1/10,000 sheets, each 8750 by 5500 yards, in three months, employing

* Commandant Roussilhe, of the French Army, has constructed an enlarging camera which is said to give a correct projection and exact focus, but the preliminary calculations and adjustments are said to take four hours for each photograph. When adjusted, however, it can be used for photos taken at any angle.

about six topographers and twenty draftsmen on the work; or about 5 square miles per man per month. This included the plotting of the grid and trig. points, preparation of the compilation diagram, plotting of the photographs and the fair drawing of detail, water and contours on separate plates: the whole process of survey, except the triangulation, typing of names, and the reproduction.

This map was never systematically checked, but the tests applied to our maps in the field were pretty exacting, and no serious errors were detected. I am confident that in flat country, particularly in close well-wooded country such as in the region round Hazebrouck to which the above figures refer, mapping from air photographs in this way is incomparably quicker and just as accurate as any other method of survey at present known to us.

Before the drawing is reproduced it is always advisable to have a final check made on the ground to ensure that the interpretation of the photographs has been correctly done. Our method was to take a print from the fair drawing by "Ferrogallic" or "Ordoverax" process, cut this up into pieces of convenient size and mount it on card. The surveyor then took this to the ground and noted on it any errors in "interpretation" or omissions. These latter were not surveyed but simply marked in roughly in their correct place, being plotted subsequently from the photograph print. Experience showed that this final check, which did not take long, was a very necessary part of the whole process, even when the plotting had been done by very experienced men. When, owing to the maps being of parts of enemy country, this check was impossible, its place could be taken to some extent by comparing the map with "oblique" photographs also taken from aeroplanes. These "obliques" were taken from a low altitude and give a sort of panoramic view on which vertical objects such as trees, buildings, and churches, etc., show up very much more clearly than on the ordinary vertical photographs. Unfortunately they were rather difficult and dangerous to take, and we could not count on obtaining them, at any rate from the most favourable positions.

The time taken in adjusting the enlarging camera and apparatus varied with the amount of distortion of the photograph, but averaged about five minutes. If the photograph is very much distorted it is difficult to get the image in focus all over the board, and this method of plotting is therefore not very suitable for very tilted photographs.* We rarely used tilted photographs for plotting work, but it would appear that the Germans, owing to their inferiority in the air, were compelled to place considerable reliance on them, and they appear to have used a different method of plotting, which I will describe later on. Before doing this I will say a little more about our own methods.

Having completed the map as described above, we had to keep it up

* See note on previous page.

to date by plotting on it all new trenches, battery positions, and the like which appeared on subsequent photographs. It was rarely necessary to use the enlarging lantern for this purpose, as, having once completed the map, one could always obtain a large number of suitable fixed points on any photograph and plot with sufficient accuracy and speed with the proportional compass. Occasionally, however, it is desirable to plot a point with greater precision; such points may be points required to enable another photograph to be plotted or points required by the artillery for use as a "datum" or "zero" point for registering or observing their fire. For such points the method known as the "four-point method" is often most suitable. It is as follows (see Figs. 1a and 1b):

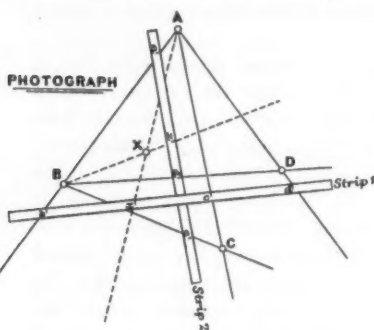


Fig. 1a

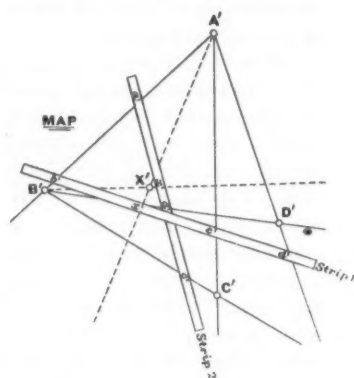


Fig. 1b

Assuming four fixed points can be identified on the photograph, then using one point as apex, join it to the other three both on the photograph and on the map. On the photograph draw a line from this apex to the point to be plotted, then taking a slip of paper with a straight edge, lay it across these four lines, roughly at right angles to the centre one, and "tick" off on the edge of the slip the points where each of the lines cut it. Transfer the slip then to the map and lay it across the corresponding lines on the map, moving it about until the three "ticks" due to the "fixed" rays on the photograph come over the three rays ruled on the map. Now mark the map at the tick corresponding to the ray to the point to be plotted. A line joining this mark to the apex passes through the true position of the point on the map. Repeat the process using another apex to obtain a second ray, whose intersection with the first gives the position of the point. Using a third apex one gets a third confirming ray which should also pass through the point and gives a check on the accuracy of the plotting.

These methods are theoretically accurate whatever the inclination of the photograph provided the points lie in the same plane, and in practice,

when this is the case, the three rays obtained in this way give a perfect trisection. The proof depends on the fact that the anharmonic ratios of four points on a straight line are not altered by a perspective.

When instead of one point only a number of points have to be plotted by this method, it is best to stick the photograph down on a piece of paper and rule in the rays from the apex, produce them beyond the edge of the photograph and rule in the transverse line. Cut or fold the paper along this line, and, having ruled in the corresponding rays from the apex on the map, place the photograph over it, face upwards, and turn it about till the transverse line comes in its correct position, when it is ruled in on the map also.

The transverse lines are then scaled, and plotting can proceed without ruling further rays on the photograph by simply laying a straight-edge from the apex to the point to be plotted and noting the scale reading where it cuts the transverse line. The corresponding ray is plotted from this scale reading on the map.

I will now go on to describe some of the methods which appear to have been used by the Germans. The most useful of these is based on the principles of perspective in freehand drawing, and may be described as "perspective plotting" (see Fig. 2).

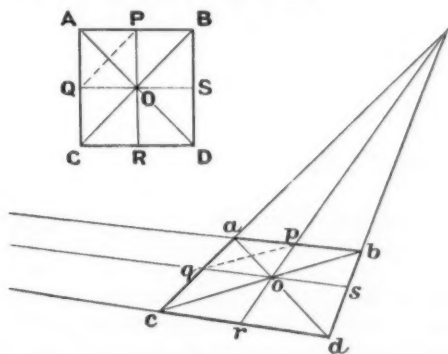


Fig. 2.

Suppose ABCD to be a square on the ground. In a photograph taken truly vertical this will appear as a square, but on a tilted photograph it will be seen in perspective and appear as a quadrilateral, *abcd*, of which the sides *ba* and *dc* converge to a "vanishing" point on the left, and *ca* and *db* to another "vanishing" point on the right.

The plotted position of O will be given by joining the diagonals of this figure and the positions of P, Q, R, S, by drawing lines from the two "vanishing" points through O. By joining PQ, PS, QR, SR, we can still further subdivide the true square and its perspective view and obtain

further corresponding points on map and photograph, and this process can be continued indefinitely. The principle of perspective here involved is applicable of course to any figure; the square is selected for an example, as it is the easiest in which to follow the connection between the original and the perspective view.

To plot from a photo by this method it is necessary to select a quadrilateral figure formed by four fixed points on the map and the corresponding figure on the photograph (Fig. 3). Join up the sides and diagonals and produce the converging sides to meet, both on the map and on the photograph. Then from each of the "converging" points draw a line

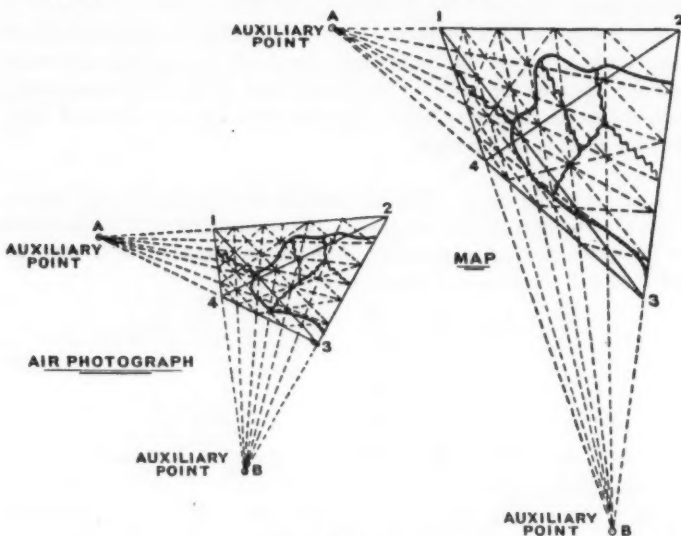


Fig. 3

through the intersection of the diagonals to cut the two opposite sides of the quadrilateral. This subdivides each quadrilateral into four corresponding smaller quadrilaterals of which the diagonals are again ruled in, and the process carried on till finally both map and photograph are covered with a grid of lines joining points which correctly correspond to each other. When this grid is sufficiently small it is easy to sketch in by eye all the intervening detail on the photograph by its relation to the grid-lines. This method is useful for dealing with considerably tilted and distorted photographs, but is naturally not so satisfactory as our method of rectifying the print in a camera when the latter is possible. We never had occasion to use it, as, for mapping work at least, we were almost always able to obtain photographs which were very nearly vertical.

Tilted photographs are always objectionable for plotting by this or

any other method, for the reason that differences of level on the ground introduce large errors ; they can only be used with safety in flat country.

If five fixed points are available, plotting may be done in a similar way without the use of the auxiliary points obtained by producing the sides of the figure, by simply joining up each point to the three points opposite to it, and then from each point drawing a line through the intersection of the diagonals drawn between the other four points and obtaining two corresponding grids in this way.

It will have been observed in all the foregoing methods of plotting that at least four fixed points are required.

At first sight it might be seen that three points should be sufficient, and it may therefore be as well to consider at this stage the geometry of the plotting to see why four and not three points are necessary.

In Fig. 4a, suppose AB be two fixed points on the ground and C a point

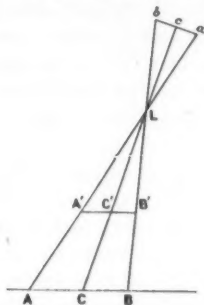


Fig. 4a

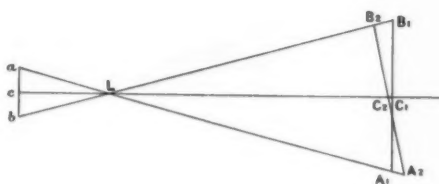


Fig. 4b

intermediate between them, a, b, c being the corresponding points as they appear on the photographic plate. Now, if on the plate c is exactly halfway between a and b , the line CL will bisect the angles aLb and ALB . The point C on the ground will not however be exactly halfway between A and B unless the photograph is truly vertical, that is unless $AL = BL$.

Suppose, then, we have our air photograph acb and wish to plot the point C in its true position between a and b ; we wish to plot it in the position C' where $A'B'$, the correct *map* length of AB , is parallel to AB .

What we actually do with the photograph by means of the camera lucida or the enlarging lantern is shown in Fig. 4b.

We throw an image on to a board $A_1C_1B_1$ whose dimensions we can regulate by moving the board and the focus until $A_1B_1 = A'B'$. We can, however, also alter the length of any line in the image by tilting the board. When we do not know the angle at which the photograph was taken how are we to know which means to adopt ?

Obviously we do not know which to adopt unless we have other data.

If we know the ratio AC to CB we evidently can get the adjustment along the line AB correct by moving and tilting the board till A_1B_1 is its correct length and A_1C_1 and B_1C_1 are also correct, that is into the position $A_2C_2B_2$, which is the only position which will have all the elements correct. To adjust in any direction in this way we therefore require three points. To adjust the whole photograph, which is in two dimensions, we must however adjust in two directions at right angles to each other, and we therefore require three points in each of two directions. One of these points can be a common point used for each direction, making five fixed points. If however we start with a quadrilateral of four points, the intersection of its diagonals gives us a fifth on both map and photograph, and we see therefore that four independently fixed points is the minimum number which give sufficient data in themselves for accurate plotting.

It may happen, however, that four independently fixed points cannot be obtained. Should this be the case it is necessary to supplement the intrinsic data on the photograph from other sources. If the focal length of the lens used is known a photograph can be accurately plotted from

three points only, by a method evolved by the Germans and known by them as Hugerstoff's Pyramid Method.

This method requires a complicated geometric construction for plotting of each point, and I am thankful to say I have never had occasion to use it. It is as follows:

If we draw in the rays from three points on the ground through the lens of the camera to their images on the photographic plate we obtain two pyramids of equal apex (as in Fig. 5).

If we can determine this apex we can reconstruct the two pyramids because we know the lengths of the sides forming the bases of each, namely, ABC , formed by the three fixed points on the ground, and

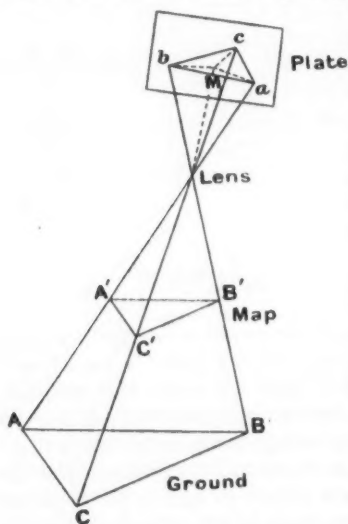


Fig. 5

a , b , and c , the corresponding points on the photograph.

If we know the focal length of the lens used and the centre of projection we have all the elements necessary to reconstruct the pyramid within the camera and from it determine the apex, after which we can proceed to reconstruct the other or "map" pyramid, a section of which $A'B'C'$ parallel to the ground such that $A'B'$ is the map length of AB gives us the representation of the ground on the map.

The focal length of the lens being known, the centre of projection is obtained nearly enough by the intersection M of the lines joining the corners of the negative, and the lengths aL , bL , and cL are obtained from the right-angled triangles aLM , bLM , and cLM . This is done graphically as follows (see Fig. 6):

Join ABC on the photograph and the corners of the print to find M . Draw a line O_1M , equal to the focal length of the lens, and a line at right angles to it, along which step off MC_1 , MA_1 , MB_1 equal to MA , MB , MC . O_1A_1 , O_1B_1 and O_1C_1 are therefore the sides LA , LB , and LC of the camera pyramid.

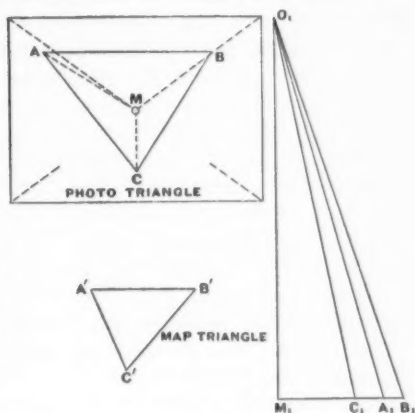


Fig. 6

We can now proceed to reconstruct this pyramid on paper. To do this we must imagine the pyramid cut down the side LC , the adjacent sides opened out flat and the base folded down till all faces lie in the same plane.

The pyramid is reconstructed on this plane surface as follows (see Fig. 7):

Draw a line O_2A_2 equal to O_1A_1 . Then with O_2 as centre and O_1B_1 as radius draw an arc of a circle, and from A_2 as centre and ab as radius draw another arc cutting the first in B_2 . $O_2A_2B_2$ is the face of the pyramid Lab . Next draw in the base $A_2B_2C_2$, which is the triangle abc on the photograph. Then with O_2 as centre and radius O_1C_1 describe two arcs, one on each side of the face $O_2A_2B_2$; with A_2 as centre and A_2C_2 (or ac) as radius describe an arc cutting one of these in C_3 , and with B_2 as centre and B_2C_2 as radius another arc cutting the other in C_4 . Join O_2C_4 and O_2C_3 ; then $O_2C_3A_2$

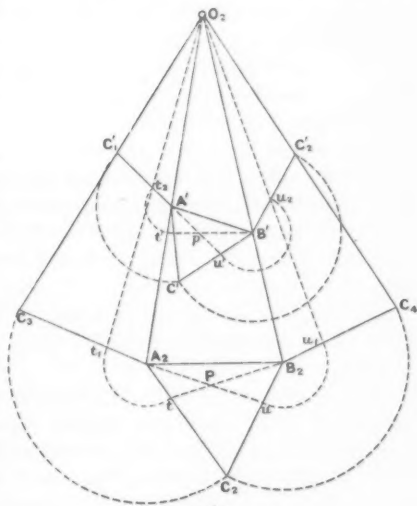


Fig. 7

and $O_2C_4B_2$ are the other two faces of the pyramid, which is now completely reconstructed.

We can now proceed to reconstruct the map pyramid $LA'B'C'$. We have already got the apex drawn since it is the same as the apex of the camera pyramid, and we require to draw the base $A'B'C'$. The best way to do this is to draw $A'B'$ on tracing-paper, and on this trace draw an arc with centre A' and radius $A'C'$, and another arc with centre B' and radius $B'C'$. The intersection of these will obviously give the position of C' with respect to $A'B'$ or the base of the required pyramid, and we require to place this base correctly on the face $O_2A_2B_2$. This is done by laying the trace over the drawing and turning it about till A' and B' lie on the lines O_2A_2 and O_2B_2 respectively, and the two arcs cut the sides O_2C_4 and O_2C_3 at equal distances from O_2 . In this position the points are pricked through on to the drawing and give the positions of $A'B'C'$ on the map pyramid, the positions of C' on the two sides being lettered C'_1 and C'_2 .

Individual points, whether lying within or without the triangle ABC , can now be plotted as follows :

Let P be such a point on the photograph. Join A_2P and B_2P and produce these lines to meet the opposite sides, produced if necessary, at u and t respectively. Then with B_2 as centre and radius B_2u draw an arc cutting the side of the camera pyramid B_2C_4 at u_1 , and with A_2 as centre and at as radius draw an arc cutting the side A_2C_3 at t_1 . Join O_2t_1 and O_2u_1 , cutting $A'C'_1$ and $B'C'_2$ at t_2 and u_2 respectively. Then with centre A_1 and radius A_1t_2 and centre B' and radius $B'u_2$ draw arcs cutting $A'C'$ and $B'C'$ at t' and u' respectively. Join $A't'$ and $B'u'$, and the intersection of these two lines gives p , the plotted position of P on the base of the map pyramid, that is on the map.

This method of plotting is so slow and laborious that having plotted a fourth point in this way it is probably better and quicker to plot the rest of the photograph by one of the four-point methods already described.

The Germans apparently made use of several other methods which are extensions of or modifications of these two and probably also photographic methods very similar to our own. Captured documents also mention a "stereo-plotter," but I do not think we have any information as to exactly what this apparatus is or how much it was used.

To turn now to the use of air photographs for showing up the shape of the ground and determining vertical relief. Though "stereoscopic" examination of air photographs has been employed for some time, certainly more than two years, I know of no instrument or apparatus, such as the stereo-comparator used in panoramic photograph surveying, which has yet been devised for accurately plotting vertical heights. I myself devoted a good deal of attention to the study of aeroplane photographs in relation to contouring, and found that though it was often possible to obtain great help from them, such help, however, could not be reduced to terms of

exact measurement of height or anything in the nature of plotting. When the slopes are steep, as for example in the dunes along the coast or along the Mont des Cats-Kemmel Ridge, the stereoscopic use of air photographs often shows the shape of the ground very well, but to transfer the view thus obtained to the map in the form of contours without the help of some apparatus is more in the nature of art than exact science.

With good stereoscopic photographs in such country it is not difficult to pick out the tops of the ridges, bottoms of the valleys, and the "peaks" which can be marked on the photograph and plotted in the usual way. This will give a very good general idea of the shape of the ground, but one cannot get the absolute height in this way or say which of two "peaks" or ridges some distance apart is the higher, and it is necessary therefore, for drawing contours as opposed to form-lines only, to observe as many heights as possible with a theodolite or clinometer.

On the Mont des Cats we were able to observe a number of such heights, and the resulting contours, though by no means perfect, were a great improvement on anything which had existed before; subsequent examination showed that they gave a very fair idea of the shape of the ground, and were rarely seriously inaccurate in absolute height. Apart from stereoscopic photographs, however, air photographs often give useful information as to the hydrography. In the chalk region of the Somme Valley "hanging woods" growing on the steep sides of a valley, of which "Caterpillar Wood" is a well-known and characteristic example, give a good idea of the trend of the valley bottom. In the Ypres area the valley bottoms are often revealed by the "lush" meadows, which can usually be picked out on the photographs. Tillage lines and boundaries of fields generally bear some relation to slope and drainage, which can sometimes be deduced from them.

All these points, however, are no more than indications; and though care, judgment, and experience in observing and applying them often results in a surprisingly good approximation, it cannot be said that it is yet possible to rely on an air photograph alone for anything like accurate contouring.

The contouring of maps in France interested me very much, and I put in a lot of time trying to elaborate our scanty data by examination of air photographs and other material. My printing officer used to tell me that whenever he had to print a new edition of a map I produced a new "design" for the contours. I am afraid that my "designs," in spite of the time spent on them, often came in for severe criticism. Nevertheless I must own that where the ground was suitable and it had been possible to give the matter sufficient consideration I thought the results distinctly good. Unfortunately the work took so long, and required so much care and caution in drawing conclusions, that time did not permit of detailed examination of more than very limited areas.

It should be remembered that in France we were working under war

conditions and at high pressure, and had to do the best we could with available data and apparatus in the available time. Many of our maps could have been much improved as regards the contouring if we had had more time to give to them. In using air photographs for mapping work in peace time conditions will be very much easier, and I don't doubt that our systems and methods can be greatly developed and improved, both as to the nature of the photographs and the methods of using them. The Germans, as I have said, almost certainly employed a mechanical device for determining the amount of tilt of the camera, and it certainly does not seem to be beyond the bounds of possibility to devise means of determining the scale of a photograph with fair accuracy without the necessity of providing an elaborate framework of points fixed on the ground.

In peace time a machine need not carry an observer, machine guns, or ammunition, and more space and weight will be available to devote to improving the size and type of camera used. Very little further development, in fact, is required to give us the power, not only of preparing complete and accurate large-scale maps of civilized and highly developed regions, but also of obtaining reasonably accurate maps of unexplored regions, at present untouched and inaccessible to any one but the explorer.

In civilized countries it is obvious that detailed survey by air photograph is a method which will give the minimum of inconvenience to the occupiers of the ground—we shall not need to invade their premises at all, while its accuracy will probably be greater than that now attained by any but the most expensive methods.

For accurate work we cannot of course dispense with the surveyor altogether, and in hilly country, until we can devise some satisfactory form of stereo-plotter, the air photograph will not help us very much. There does not, however, seem to be anything to prevent us making such an instrument, and when this is done it should be possible to map steep hilly regions, at present difficult to survey on account of the difficulty of getting about in them, very cheaply and quickly indeed. When it is not possible to send a surveyor over the ground to check the interpretation of the photographs, his place can be filled to some extent by the examination of "oblique" photographs taken from aeroplanes at suitable altitudes.

One may safely sum up the situation by saying that the aeroplane is already a valuable instrument for both exploration and accurate survey in flat country, and that it should not be long before its application will be almost universal, and one may venture to predict that in survey, as in many other matters, the Great War will mark the beginning of a new era.

Before the paper the CHAIRMAN said: This is another of the subjects that have received attention during the war, and are likely to be developed in the near future. Colonel MacLeod has been so kind as to attend this afternoon for the purpose of reading his paper. I will now call upon him to address us.

Lieut.-Colonel MacLeod then read the paper printed above, and a discussion followed.

The CHAIRMAN: We are indebted to Colonel MacLeod for a lucid explanation of surveying by air photographs. As he has remarked, it to a certain extent invades the premises of the surveyor of the old style. Colonel Whitlock of the Ordnance Survey is present, and I think we shall have an interesting and instructive discussion of the possible developments of this method of surveying.

Lieut.-Colonel G. F. A. WHITLOCK, R.E. (Ordnance Survey): Colonel Sir Charles Close has asked me to express his regret at being unable to be present this afternoon. He has, however, asked me to make a few remarks from the Ordnance Survey point of view. Aerial photographers in connection with survey and the Ordnance Survey have, of course, one common requirement: they must have fixed points to work on. But having got the fixed points, their methods diverge. For the Ordnance Survey large-scale maps we must have absolute accuracy. The public depends upon getting the correct areas of all the enclosures that we show on the Ordnance Maps. The enclosures are surveyed to the centre lines of each fence, wall, or enclosure. That being the case, it is, to my mind, rather difficult from aerial photographs to say where the centre line runs, especially if it is camouflaged with trees, and if you get the hedges that you do in a county like Devonshire, it would seem almost impossible. Again, the Ordnance Survey have to show all the parish boundaries, the directions of streams, and when we show houses we have to do so by their foundations. If you take a photograph of a house from the air you get the eaves and the shadow, and it is very difficult to say what the plan of the house is. Further, we must send men over the ground because the public insist on having the names on the map. Again, when you see the town maps you will notice that every house has its dividing walls shown; that of course is impossible to plot from an aerial photograph. On that score alone I think it is rather difficult for the Ordnance Survey to depart from its present methods and take up aerial photography. But there are other points of view for aerial photography. I was once on a Boundary Commission, and all I had to work on was a dotted line. If I had had something in the nature of aerial photography it would have been a very great help to me, and would have saved the trouble we had with the natives on account of getting out of the line.

Turning to the economic side of the question, there is no doubt that the figures Colonel MacLeod has given are very instructive. He says they do, roughly, $6\frac{1}{2}$ miles a month. The Ordnance Survey has finished the large-scale survey of England, Wales, Scotland, and Ireland, and we are simply now making a revision of it. It may be of interest to you to know that a man in open country will revise 160 acres a day, supplying all the new details. That is on agricultural ground. He will also supply any new names, and will pass along all the parish boundaries and see they are properly mered. If you take twenty-four working days in the month, that works out at about 6 miles, so I do not think there is very much difference between the times taken by the present methods of the Ordnance Survey and those of aerial photography. No doubt in this present war there has been every facility for getting negatives, but the question arises whether, if aerial photography were generally used, it would be possible from a practical and economic standpoint to have so many aeroplanes about and so many negatives used. In the tropics aerial photography would be of great use, or in a delta where surveying is difficult,

I am sure there is a very great field for aerial photography ; from my own point of view it is, however, difficult to say it would be of very much use to the Ordnance Survey.

The CHAIRMAN : The extreme precision required in the Ordnance Survey may perhaps tell against the photographic method, but there are other parts of the world where the method might be more suitable—in desert regions, for example, that are inaccessible to the ordinary surveyor, though there might be a difficulty about fixed points. We have with us Colonel Newcombe, who has had great experience in this matter, and some remarks from him would be instructive.

Lieut.-Colonel NEWCOMBE, R.E. : When on the Intelligence Staff in Egypt, in 1915, I worked with the Egyptian Survey to get aeroplane photos taken, but we had only four aeroplanes altogether in the whole of our Canal defence, and therefore could not do very much. Since then I have lost touch with the subject ; but from the photographs made then I am perfectly convinced that for mapping country like Egypt and the delta of the Nile the air photographs can be made to produce results far superior to the ordinary methods of mapping, except on the maps of 25 inches to the mile. A photograph gives far more information and really is far more accurate to reproduce detail, except when we want to measure feet and inches, as of course we have to do when dealing with towns and villages. Other questions are those of cost and reproduction. The photograph must have struck every one of us as being far more easy to read than the map with conventional signs. For instance, when you see a tree on a photograph you can see its type and height from the shadow thrown ; but directly you use a conventional sign you have lost record of its species, and conventional signs do not show anything like so much to the ordinary man. As regards desert survey, the photographs I saw of the desert were most wonderful. They even showed a single camel's track ; one could see where a single camel had been across the sand owing to the shadows being so deeply marked in his footprints. In countries like Egypt, Syria, Turkey, or anywhere in the East, where you almost invariably have brilliant sunshine and can guarantee to work, I suppose, the greater part of any day in the year, the aeroplane obviously has a far better chance than here. It would be very interesting if we could get somebody from the Flying Corps who has photographed in Egypt lately, and from the Egyptian Survey, to discuss the matter with the home experts. Colonel Keeling, I believe, is still in London, and, being the Director-General of Egyptian Surveys, is about to go out there. It would be valuable if he could follow the matter up on his arrival in Egypt. It would be interesting to know what are the limiting scales of aeroplane photographs when reproduced as photographs. Obviously they cannot be on too big or too small a scale ; you could not, of course, see anything on a very much reduced photograph. As regards hills, you do not want to know precisely the actual height of the hill so much as to know it is there and whether it has a steep or easy slope ; the actual height in feet is a matter of indifference to anybody except the surveyor. That much can, I think, be shown by an aeroplane photograph. Another interesting thing would be to know who is the greatest authority, besides Colonel MacLeod, on this subject, so that people in the future wishing to use aeroplane photographs would know from where to get their fullest information. I see that Colonel MacLeod has not met people from Egypt who do know a great deal about making aeroplane photographs, and who, I think, ought to know more than anybody owing to facilities of climate and weather conditions.

Lieut.-Colonel SALMON, M.C. (3rd Field Survey Battalion) : First of all, I should like to express the gratitude and admiration that we surveyors have felt towards our friends the flying men and their work. Except in extremely bad weather, they have never failed to take the enormous number of air photographs that we have asked for, often under conditions of great danger. Of course much of our work would have been impossible without their assistance.

I feel quite sure that in the future a good deal of valuable revision work could be done by air photography. For instance, in Ceylon we have quite a good topographical map of the up-country districts ; but when it was surveyed the country was divided into the cultivated portion and the uncultivated portion. Now the uncultivated portion consists of large tracts of forest and also of open patana land. These form very important topographical features ; but unfortunately the distinction is not shown on the map. I am quite certain that by air photography this could be put right. It would be a very big business to send surveyors over comparatively wild country to put in all the boundaries, but an aeroplane could do the thing in a short time. There is a certain amount of difficulty from the flying man's point of view. I am afraid in Ceylon he would probably have to learn to land in his own length, because there are few places suitable for landing. The golf-links at Nuwara Eliya and the racecourse at Colombo are probably the only two aerodromes he would find.

Major BROCK (Canadian Engineers) : Might I say that in Canada we have been using photographs to a considerable extent in surveying hilly and mountainous country by photo-topography. In doing that work we have wished very much that we could have an aeroplane to get detail of the features, the river and stream-courses, and the lakes. I remember very distinctly the first time I saw a notice in a paper of an aeroplane making a prolonged successful flight. With my topographer we talked the thing over—we were up in the mountains making a topographic map—and we wondered how long it would be before the Government of Canada could be induced to get a few aeroplanes for topographic work there. It seems to me that it would be extremely useful for work in conjunction with photo-topographic surveying. By photo-topographic methods you could fix the peaks and the main mountain ridges and the contours of the slopes with few stations, but valleys are rather more difficult without an excessive number of stations, and for them it is generally economical to secure the information by plane-table work. Thus one plane-tables the lower parts of the valleys and uses photo-topographic methods, which are very cheap and convenient, for the triangulation and for the upper slopes and peaks. Aeroplane photographs in place of the plane-table work could be combined very well indeed with the photo-topography. For a great deal of work in Canada I am quite sure we could use aeroplanes to very good advantage, in exploratory work especially. With most topographic work you get the best economical results when you combine several methods, at least we have found that to be the case in a great many districts, combining plane-table work with photo-topography or other topographical method according to the varying characters of different portions of the district. There are many methods by which an accurate map can be made. The aim of the topographer is to get it by the most convenient, easiest, and cheapest methods, which, unless the area be of uniform character throughout, will usually be attained by combining several methods. For certain purposes he can undoubtedly use air photographs to advantage.

Colonel Sir THOMAS HOLDICH : I have heard a great deal which is exceedingly interesting about the reduction of photographs taken from the

aeroplane for mapping, but it all has so far been reduction to mapping on a very considerable scale, on cadastral scales, or what you might call Ordnance Survey scales. I do not think myself that the future of flying photography lies altogether in that direction. I believe it will be far more useful when applied to purely geographical purposes. I know of thousands of square miles of country which could be mapped from an aeroplane excellently well on the system which the lecturer so well described, country which I cannot conceive can be equally well mapped by any other system. I have struggled myself for months and months through forests and jungle in a vain effort to get something like real accuracy in mapping under circumstances which almost rendered it impossible to produce anything like a perfect map, that is to say, perfect in comparison with what certainly could be done from an aeroplane. There is one question I should rather like to ask. Is there no method of applying some system of range-finding to an aeroplane which would give the relative value of heights below the aeroplane itself? That is to say, cannot the relief of the country be determined at all from an aeroplane? Colonel MacLeod has told us many ingenious methods by which it can be indicated more or less, but he has not defined any method, it seems to me, by which any one could accurately gauge the difference in height, say, between a valley and an adjoining ridge or mountain. In comparatively flat country, such as that which the aeroplanes have worked over in France, this might be exceedingly difficult, but I should have thought that in more mountainous regions where differences of elevation are very considerable, it could have been applied with very good effect. I should like to know whether any attempt at determining differential heights has ever been attempted?

Mr. HINKS: When I had the honour, about six months ago, of visiting Colonel MacLeod established in his chateau not very far from St. Omer, I felt quite sure that when the time came he would be the man we should naturally ask to explain the methods of air survey upon the Western Front, because I was very greatly impressed by the beauty of all the arrangements that he had made there. But I did not quite expect that so soon after that he would find himself established in comparative leisure and dignity in Cologne and have the opportunity of elaborating the very delightful paper that we have listened to. The question of the utilization of aeroplane photographs, and especially of getting over the effects of tilt, is one that engaged my fancy a good deal in the early days of the war. I made some attempts at the construction of apparatus for the utilization of what the French call the *chambre claire*, or what we call the camera lucida prism, and with your permission I should like to show a rough model I made which demonstrates the point. Colonel MacLeod has shown the British draughtsman's methods of using the *chambre claire*, and in the French pamphlet which General Bourgeois very kindly sent me the other day at my request, there is a good deal about the French methods. And there is one point in the description of the French methods that strikes me as being extremely applicable, both to their own arrangement and to that mentioned by Colonel MacLeod: "Il y a là un trop grand luxe de mouvements." In other words, these devices are a great deal too shaky. My own plan was to have the *chambre claire* built upon a comparatively substantial bridge. Another feature of my apparatus is to enable one to enjoy the geometric propriety of examining the air photograph always at right angles to the plate, that is to say, to view the air photograph perpendicularly, and, if necessary, project it obliquely on to the map. The whole thing can be racked backwards and forwards in order to fit the scale of the aeroplane photograph to the map, and it can be tilted so as

to enable one to look more or less vertically to the map. Unfortunately, about Christmas 1915 I went down with pneumonia, and after I recovered I found I was too far behind with other things to make it possible to go ahead with this. But I should like to say that there are great geometric advantages in the principle of the camera lucida, inasmuch as you need not worry about focal lengths—a camera lucida itself has not any focal length, and there are no such difficulties as with the enlarging lens in getting the right but variable focal length, and it seems to me the thing is worth further consideration. The question of the parallax is, I think, got over in this particular camera lucida, which I borrowed from my friend Dr. Harmer of the National History Museum, and which is a beautiful production of the firm of Zeiss, bought before the war, it having a very small aperture, which practically limits the sight to a single line, and which incidentally also gets over a difficulty mentioned by the French, that you cannot easily focus a map and a photograph at different distances. You can if you look through a small aperture. Secondly, it has a beautiful arrangement of tinted glasses which enables you to make the brightness of the photograph and the map in the right relation to one another. It would also enable you to rig up proper means of varying the illumination, which is evidently of great importance in order to be able to see anything at all, as you will readily discover if you look through this. Therefore, I do not feel at all clear that a properly built apparatus with a camera lucida would not be of some advantage. It seems to me at any rate worthy of a few more experiments.

As to the proper methods of using the enlarging lantern to which Colonel MacLeod has referred, and which his paper, apart from what he read, treats in more detail, there are some very pretty pieces of geometry involved and questions that have not been sufficiently investigated. There is an elegant theory, with which we were familiar in German pamphlets before the war, developed in the paper "Le Restitution Photographique" sent me by General Bourgeois, but with a significant sentence. After putting down certain equations which have to be solved, the author says that the practical method of solving them demands further investigation. I cannot help thinking, therefore, that now, if ever, is the time for these problems to be thoroughly solved. With Colonel MacLeod at Cologne and an able officer, who is in peace Professor of Physics at Princeton, as his assistant, we seem to have an ideal combination for working under perfectly agreeable, satisfactory, and even triumphant conditions; and I very much hope that in the future we may hear more from them.

Captain GATHORNE HARDY: I had not intended to speak, because the lecturer had said he was going to say very little about the interpretation of aeroplane photographs; but since Mr. Hinks has brought forward his interesting model, I might perhaps say that in the work that I had to do in connection with the interpretation of aeroplane photographs, one had often to bring out very quickly, more quickly than the elaborate survey methods of the Field Survey companies could produce them, some sketch-map of a very elaborate scheme of trenches which had just appeared. And for that purpose I found the camera lucida extremely useful. The photographs generally came in a large batch, and one had very little time to do the work in. I had a rough tilting apparatus made, somewhat like a toilet mirror, on to which the photographs were put, and with the aid of that you got one of the photographs to correspond with the detail of the roads on the map below, and then for any number of photographs you had to make very small adjustments with the camera lucida, to make the details fit on to the map below, and on that you could draw very quickly, because it was simply tracing for sketch-map purposes, and with quite

sufficient accuracy, the required detail however elaborate. It did not seem to me at the time that it was possible to use the camera lucida for very accurate work, and I gathered from a Field Survey Company that they did not make much more use of it than Colonel MacLeod seems to have done, although the French used it for that kind of work, and I think they regarded it as invaluable. With Mr. Hinks' means, no doubt, one might expect that it would become an aid to more serious surveying. For the sort of work I did with it, it had the advantage of extreme rapidity.

The CHAIRMAN: Before asking Colonel MacLeod to reply I will relate an experience of my own, which shows how easy it is to fall into error in this matter. Many years ago I attempted to make a panoramic photograph of a line of cliff from a small rock in the sea. The cliff was perfectly straight. I took a series of photographs of it from the rock and mounted them together as a panorama. They fitted well, but the cliff appeared in the panorama as a pronounced curve, a result which was fatal to the object I had in view. It is clear that if you were to take air photographs from a fixed spot, supposing such a thing to be possible, and were to combine those taken vertically with those taken obliquely, you would obtain a highly distorted view of the surface of the Earth.

Colonel MACLEOD: The principal questions to which I have to reply are those raised by Sir Thomas Holdich. As to the possibility of using aeroplane photographs for plotting vertical heights, I think such plotting is certainly within the bounds of possibility, but I feel I have not made sufficiently clear the fact that during this war we have been all the time learning. Those of us engaged on plotting aeroplane photographs had never seen or thought of such a thing before, and when photographs arrived we had no time to think out the theoretically best way to use them. The early methods, undoubtedly, were not the best, and it is only lately that we have really had time to go into the matter from the theoretical point of view. In the pamphlet to which Mr. Hinks has referred, written by Lieut. Sasportès, he mentions the possibility of plotting photographs without determination of points on the ground, and also of some kind of stereo-comparator analogous to that used for panoramic photograph surveying now. But I am afraid, beyond seeing that there must be possibilities for such an apparatus, I know no apparatus of that sort. I have certainly never seen one. I cannot therefore say how it can be done. Still, we hope that Captain Wedderburn, the officer to whom Mr. Hinks has referred, who is a Professor of Physics at Princeton, and who is at present working on these questions of plotting without the use of fixed points on the ground, will be able to perfect the arrangement with the enlarging camera, or possibly evolve a method of plotting heights as well. That takes me on to saying a few words as to my view of the relative merits of the camera lucida against the enlarging lantern arrangements. The camera lucida has many geometrical advantages. You are not bothered at all with the question of focal length. On the other hand, it has this great disadvantage, that every drawing has to be done twice over. If you are using the camera lucida you have your eye to the prism and your pencil down below, and have to run over every line with your pencil. If there is a great deal of detail on the map that takes a long time, and that has to be traced again on to the fair drawing before it is ready for reproduction. With the enlarging lantern, provided you have got over the difficulty of focus, all your drawing is done for you in one short exposure of a few seconds with a minute or two for developing and without any possibility of making a mistake. With regard to the adjustment of the camera lucida, to get absolutely correct

projection you must know the focal length of the lens used in taking the aeroplane photograph, and you must also understand fairly thoroughly the principles of perspective, and so on, on which it is based. So that in the hands of anybody who does not know exactly what he is doing it may go wrong. With the enlarging camera apparatus I do not think you can make a mistake; provided you get your four points to agree exactly, you have a correct projection, and your print will be absolutely correct. The difficulty of focal length, I feel sure, is only a difficulty because we have not had time to work out the best methods of making the adjustments. With the French camera devised by Commandant Roussilhe, they say it takes four hours to make the adjustments for a single photograph, and I gather from this pamphlet that they have to do a good deal of preliminary calculation. I feel sure that four hours can be reduced a great deal. With our rough-and-ready method we found that by letting the focus go we were able to adjust each photo in about five minutes, but we never used any photographs which were not nearly vertical. If they were very distorted we rejected them and asked the Flying Corps to take others; they were very obliging in that way, and the quality of the photographs was, I consider, wonderful. I feel sure the difficulty of the focal length can be got over, and if it can I myself prefer the enlarging lantern as both quicker and more accurate than the camera lucida and entailing far less strain on the workman, which is an important consideration.

The CHAIRMAN: I think you will agree with me that we are indebted to Colonel MacLeod, not only for an extremely interesting paper, but for originating a very instructive discussion. I will ask you to pass a hearty vote of thanks to him.

A RECENT TRIP INTO THE CHUMBI VALLEY, TIBET

Lieut.-Colonel Sir Walter Buchanan, K.C.I.E., I.M.S.,
Calcutta

THE following account of a recent trip through the Chumbi Valley of Tibet describes this part of Tibet as it now is, and shows the changes that have taken place since the days of the Mission-Expedition of 1903-4, mainly due to the entire disappearance of Chinese influence.*

Up the Chumbi Valley to Phari Dzong.

The journey has not been done (except by the few Sikkim officials on duty and by a Calcutta artist) since the close of the Tibet Mission-Expedition under Sir Francis Younghusband and General S. R. Macdonald in 1903-4.

We arranged to go into Tibet by the Natu Pass (14,400 feet), to go up the Chumbi Valley to Phari, and come out by the well-known trade route over the Jelep La. We decided to take pack-pony or mule

* For the Expedition, see admirable books by Colonel Waddell, P. Landon, and E. Candler; all are good, but for this portion of the way to Lhasa that of P. Landon is the fuller.

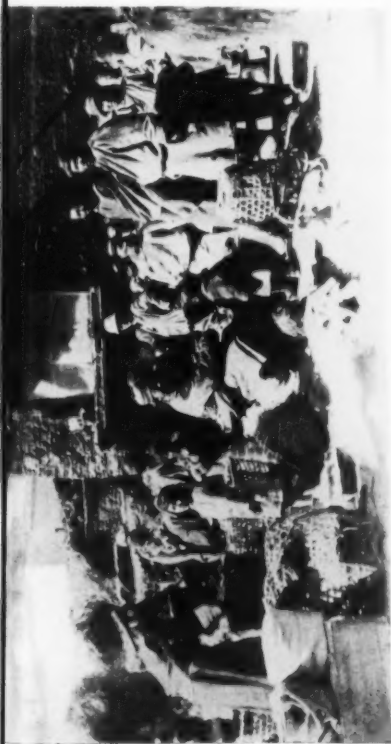
transport with us, and we found it on the whole much more satisfactory than coolies, whom we had employed on many trips through Sikkim.

The road to Tibet starts from the rather shabby rest-house. After 5 miles we reach a small village called Lagyap, near which in the days of the expedition of 1903-4 a difficult pass had to be negotiated. This Lagyap Pass is not now used; a decent bridle-path now runs round the hill, and then on to the place (9500 feet) called Karponang, consisting of only a mule camping-ground and a small whitewashed rest-house (Karpo nang, "the White House," in Tibetan*). Next day we set out on a short march of 10 miles to Changu (12,600 feet). The first 3 miles are very rough, though possibly not so bad as in the Expedition days, when the "10th to 13th" mile were proverbial for badness. In several places the road has been cut out from the rocky cliff, with deep *Khuds* or precipices on the outer side, especially at a point between mileposts 13 and 14 (from Gangtok). This passed, we turn up the Changu Valley, which soon widens out till near the 15th milepost it divides into two, of which we take that on the right hand or east, and after crossing a log bridge keep along the left flank of this valley, parallel with the Changu torrent. The sides of the valley are lofty and rocky, while the river and the hills for several hundred feet up are densely covered with rhododendrons of all varieties—a sight which in the month of May must equal in beauty, or possibly surpass, the famous 30 miles of rhododendrons on the better-known tourist route from Tonglu to beyond Phallut, on the Nepal Boundary road. Near the 17th mile we see before us a ridge blocking the head of the valley, and a stream tumbling over it to form the Changu River. The path zigzags up to this ridge, which we find to be the end of a splendid lake, 1 mile long and 600 feet broad, bounded on the west by bare rocky hills, and on the east by a steep hill covered with rhododendrons to its summit. The road runs along the west bank to a small draughty wooden bungalow at the north end of the lake (12,600 feet). We had snow and sleet that afternoon, but next morning was fine and frosty. Starting early we soon reached the ridge beyond the lake, and got a close view of the Cho La (the "Chola Pass"), formerly the great route into Tibet, from which the Dikchu River (Ryott of Hooker) takes its rise. In early days, when the Sikkim Raj had its capital at Tumlong, the Rajas used to keep this road over the Cho La as their nearest way into the Chumbi Valley of Tibet, where they preferred to live and (like our early King Georges) treated it as a sort of Hanover. Near this pass Hooker and Campbell were captured by the Sikkimese in 1849. The road then runs over a level upland or alp and round a huge bay or amphitheatre (2 miles long); then on turning the corner the passes lie above us, and the road runs on the left side of a very deep gorge

* The name was given, it is said, by Landon, the *Times* correspondent. It has remained, though in strict Tibetan it should be *Nang Karpo*, cf. *Ta Karpo*, *Chorten Karpo*.



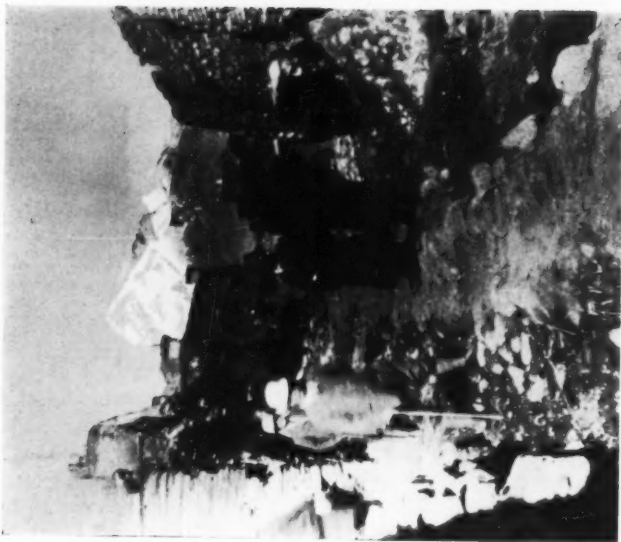
KAGIN MONASTERY ABOVE CHUMBI VALLEY ON WAY DOWN FROM NATHU LA



THE BAZAR AT PHARI



PHARI - 4 MILES FROM PHARI



THE MAIN STREET OF PHARI: CHUMALHARI IN DISTANCE



ON ROAD TO PHARI NEAR ANUNO: CHUMALHARI IN DISTANCE

which receives the drainage from the Natu Pass and the neighbouring hills (all about 14,000 to 16,000 feet). The way lay along the side of this deep gorge for about 2 miles, then zigzagged down to a small picturesque lake at the foot of the pass, at a place called on the maps Sherab or Sherabthang, a camping-place in Expedition days. From here a broad transverse stony valley runs along at the foot of the passes till it meets the road to the Jelep, 4 miles to the south-east. We keep up towards the Natu Pass, and soon reach a new signpost showing the way to Kapup (which is $2\frac{1}{2}$ miles from the top of the Jelep Pass), and the way up the hill to the Natu. The better road, which existed in the expedition days, has been neglected, but a fair bridle-path exists which soon led us up to the milepost (G. 26 N.O.), which also for us marked the beginning of the deep snow. For a while the path was clear enough, till we reached a point from which we could see the cairn on the top of the pass. The road was now obliterated with snow, but two of us had been up twice before and knew that we could safely steer for the cairn at the top. From the pass could be seen part of the Chumbi Valley and Mount Chumalhari, beyond Phari in Tibet, and to the south the plains of Bengal and its winding rivers. On the Tibet side no road was visible till below the snowline several hundred feet down; but the snow was firm, and we stumbled, slid, and glissaded over it, now and then sinking up to our armpits when we got too near a rhododendron bush buried in snow. Our animals followed us laboriously, but an hour's time saw us on the clear track below the snow. The road descends rather rapidly, so soon we reached the pine forests, and 5 miles from the top of the pass we came to the picturesque Swiss chalet-like wooden bungalow of Champithang (about 13,000 feet alt.), an excellent rest-house with plenty of fuel for the fires. We were in Tibet and beyond the rain, fog, and mist of monsoon-drenched Sikkim.

Below us lay the Chumbi Valley and the River Amochu; to the south-east the huge snow-covered ridge which divided us from the neighbouring hills, the Jelep.

From Champithang to the Chumbi Valley the road runs downhill, at first in easy gradients. About a mile below the rest-house we had a grand view of the pyramidal peak of Chumalhari, and on looking back a fine view of the Natu Pass from the Tibet side. Further down we see in a deep valley on the right, the ruins of the houses and barracks which once were *old* Yatung. *Old* Yatung was the place where Sir Francis Young-husband's Mission, after crossing the Jelep, met with a feeble show of resistance. It is a very narrow part of a valley, quite unsuitable for a camp or place of residence. The old Chinese barracks still remain, roofless and ruined. The name Yatung is *now* given to "New Chumbi," the residence of the British Trade Agent situated 6 or 7 miles up the Chumbi Valley, in a fine open space to be described below. "Old Chumbi" is the name of a small village in the valley, on the Amochu and close by the *present* Yatung.

About 3 miles out we pass over a bad landslip, and a mile further on we reach a point with a magnificent view of the Chumbi Valley and of the bright green sparkling waters of the Amochu River, as it makes for the pass into Bhutan, which it traverses to become, in the Duars, the Torsa River, and join the Bramaputra in the plains of Bengal. This is the destined line of the locomotive should time ever lead to the necessity of another expedition into Tibet. Looking back from here we can see the two great passes, the Natu (over which we have come) and the Jelep by which we were to return, both snow covered (October 21). A few minutes later we catch sight of three *Chortens* on a ridge above the important monastery of Kajui (or Karjui). We are now well out of the forest, and leaving pines and junipers we descend over bare grassy hills to the Kajui Monastery, where we were hospitably entertained by the Lamas to the inevitable salted tea, and shown over the buildings. The Buddha statues were very good, as also were the pictures on the temple walls.

Very soon after leaving Phema (or Chema) and crossing a bridge we came to the remains of what was till recently a flourishing Chinese town called Pibitang. It is practically deserted and in ruins; all trace of China is gone, except for some Chinese characters still clinging to the walls and a few coloured drawings of fearful Chinese warriors in mail armour, with moustaches as fierce as their daggers!

Leaving this bit of old China, we rode along a level but rough stony road and passed through "Old Chumbi," a few houses, among which are the remains of what was once the palace of the Rajas of Sikkim. On passing old Chumbi the valley opens out, the road still keeping close to the Amochu River. We pass a tiny village known as Eusakha, and in a few minutes are in New Yatung, the headquarters of the British Trade Agent.

Most of modern Yatung lies on the east bank of the Amochu, which runs clear and glittering through the town. The valley here is wide, and there is ample room for the small bazar, the offices and residence of the Trade Agent, and for a row of barracks for his guard and escort. Supplies are available from a Commissariat overseer, who keeps them for the use of the few officials going on to Phari, and to our small garrison at Gyantse, where another British Trade Agent resides.

The altitude of (new) Yatung is 9780 feet above the sea-level. The minimum temperature in the end of October was only 42° Fahr., but it falls to 20° Fahr. in the winter. In the summer the climate is superior to anything in the Darjeeling Hills or in Sikkim. European vegetables of all kinds can be grown and many kinds of fruit (especially apples). There is a British Post and Telegraph Office, a dispensary, and even a long-distance telephone to Gyantse. Half a mile beyond Yatung the valley divides; one branch, the Kambo Valley, leads up to some hot springs, which are locally celebrated for their virtues, even by the never-washing Tibetans.

We keep up the main valley (to the right) following the Amochu River, past a small bridge leading to a little Gumpa or temple across the river. Soon the valley narrows; on the left are high precipitous rocks, 1000 feet above us, on top of which is another *Gumpa*, not unsuitably named Gab-Dzong (or the Vulture's Fort), and round the corner a place famous in the Expedition days, called Chortenkarpo (the white Chorten). The road and river wind through a narrow gap, "where half a hundred might well be stopped by three," and indeed a half-hearted attempt was made to stop Sir Francis Younghusband's party at this place. A wall with a gate used to run down to the river on both sides; now both are gone, only a few bits of the walls remain, with the remains of the Chinese barracks, on the right, where once a Chinese garrison guarded the pass. All is now in ruins; the stone houses stand; the woodwork has been removed, but on the walls of the chief house are still to be seen pictures of painted emperors and fierce armour-clad warriors.

Close by the big prosperous village of Galingka we passed a long string of mules and pack-ponies coming down with wool from Lhasa, and stopped to have a talk with a traveller (a well-known man and a "Khan Sahib") who was journeying from Lhasa back to Ladak, and found it easier to return *viâ* Chumbi, Darjeeling, India, and Kashmir than to face the long trek across Tibet to his home in far-off Ladak. Galingka is well situated and is a typical Tibetan village. Many of the houses are substantial, stone walled, and roofed with shingle, held in place by huge stones. The long flat Lingma plain (Lingmathang), described by all writers on the Expedition of 1903-4, was covered with thick long grass, and as we went up was absolutely deserted; on our return a few days later the whole was covered with black yak-hair tents (we counted 150), and hundreds of people were cutting the grass and carrying it away on mules and ponies; a busy harvest scene, which we did not expect in this austere land. At this point upper "Tromo" or *upper* Chumbi begins; Lammergayars (*Gypactus barbatus*) flying aloft, like small aeroplanes, to use a very modern simile.

At the north end of this flat plain the valley is blocked by a huge rock, the "Ta Karpo" of the Expedition, a bare conical mass. The Amochu, recently so swift and smooth in the plain, becomes again a fierce torrent. We cross a bridge to the other bank (right) and go up a long rocky defile or canyon to the rest-house at Gautsa, "the plain of gladness," an open short valley where the river divides to flow round some jungle-covered small stony islands, some of which were even cultivated by the few inhabitants of this small village. Gautsa is an important halting-place for the wool-laden pack-mules, and on this day's march we happened to count the animals carrying wool down to the railway and mart near Kalimpong. They numbered as many as 360.

The road for Phari ascends at once after leaving the village and reaches another deep black canyon. It is so rough that only a mule or

a "Bhutia" pony could be ridden over it or carry a load. After some 3 miles we leave the canyon, the valley widens, the road runs on the right bank high above the river which roars in a deep gully below. We rapidly descend to a small flat plain (13,300 feet), called Dotag, an earlier formation on a smaller scale like the Lingma plain below. Across the plain is the "Frozen Waterfall" of the Expedition. It was not frozen when we passed it (October 25 and 29), but the bare hills all round were snow-covered. In the winter days of the Expedition this otherwise admirably flat camping-ground was known as the "coldest spot in Asia"!

Riding for some 3 miles through a widening valley we are at Kamparab and on the edge of the great plains of Tibet.

We have left Himalayan scenery behind, and the Chumbi valley. We soon caught sight of Phari with its dzong or fort, and were at first puzzled by the long rows of black lines around the walls of the fort. These on nearer view were found to be the black walls of the turf-sod houses which comprise the town of Phari, the highest (altitude 14,570 feet), the most dirty and the quaintest town in the world, higher by some hundred feet even than the villages in the higher Andes.

We arrived at an auspicious moment in the middle of a "harvest home." All round the dzong and the town were loose heaps of earless barley-straw; dozens of men, women and children were busy packing up huge bales of straw and carrying them to be stacked on the flat roofs of their turf-walled houses, these being the only places where the valuable fodder could be stored safe from the numerous mules, ponies and yaks which were grazing round the town. This earless barley is useless as a human food, but it is much needed as fodder for the mules and ponies which carry the wool from Lhasa to the Indian market. The people obtain their grain for food mainly from Bhutan over the neighbouring pass, the Tremo La. It was over this Bhutan Pass (Tremo La) that Warren Hastings' agents, Bogle and Turner, as well as the eccentric Manning, entered Tibet.

The Phari fort is a strong stone square building on a slight elevation above the town, which surrounds it more or less, and especially on the south. Manning, who arrived at Phari in the same week in October, 1811, as we did in 1917, described it in his disjointed diary in four words, "dirt, dirt, grease, and smoke," and it cannot be said that the passage of one hundred and six years has rendered this terse description any the less applicable. The fort is said to be of Chinese origin; it has been repaired since the Expedition of 1904, and the inside has been (to judge by the descriptions of 1904) considerably altered. The town is very quaint; the dirt of ages lies around, and snow persisted since the previous winter in many corners. The floors of the black sod-huts are generally below the level of the ground, and are entered by a couple of steps from the road. This may be due to their being warmer by being so made, though most travellers have attributed it to the raising of the

road outside by the accumulated filth of ages. There are generally no windows, the door and the smoke-exit in the roof sufficing for ventilation, but two or three of the more important houses had a window covered with China paper. In spite of all these sanitary defects (as we would call them) the people generally are healthy and sturdy. Goitre is very rare, and this in marked contrast (we were told) to its prevalence in the neighbouring Bhutan valley of Paro. Sore eyes were very common among the bright and intelligent children, but adults seem to have outgrown that trouble, which is, of course, produced by dirt and the irritating smoke of the yak-dung fires.

The views from Phari are splendid. The plain is surrounded by distant low hills, mostly snow-topped. The grand mountain of Chumalhari (23,960 ft.) on the north-east towers 9000 feet above the fort and town, like the Matterhorn above Zermatt, and is quite close (some 6 miles off). As we stand with our backs to Chumalhari, there lie before us the northern aspects of the great Dongkya Peak (as Hooker always calls the great hill known on the maps as Pawhunri) and part of Chomiomo. To the south through a gap in some lower hills we saw the snow-covered Bhutan Mountains (Masongchongdrong). Due north across the plain we see the small monastery, Chatsa, and beyond it the open smooth pass called the Tang La, 15,200 feet, on the way to Gyantse and Lhasa, near which was the first unexpected fight with the Tibetans in 1904. To this spot some of our party rode during our stay at Phari; it is about 9 miles off, and on reaching it the syces raised the well-known cry "*Ki ki so so Cha Gyal lo*" as they topped the pass. From here in the distance could be seen herds of the kyang or untamed wild ass of Tibet (*Equus hemionus*). One of these kyangs captured while young was purchased for £25 by one of our party, who is President of the Calcutta Zoo. The animal was safely brought to Calcutta, and after one year there through a Calcutta hot weather, is fat and flourishing, though its *habitat* is 14,000 feet and over. Having spent three days in this fascinating place we had to return, and in two days reached (new) Yatung again.

The road from old Yatung up to the Jelep rises 5000 feet, and is extremely bad. It is extraordinary that so bad a road can be used as the main trade route from Tibet to India. No wonder we were told of the short lives of the mules that have to carry heavy loads up it. We can only attribute this to the "forbidden land" policy, which still governs our dealings with Tibet, with Bhutan, and with Nepal. About halfway to the pass is a Tibetan rest-house, where we halted till our laden mules and servants got up. Just as we reached the cairn which marks the top of the pass and re-entered Sikkim we were met with a cold deluge of snow and sleet, which turned soon to rain and thoroughly drenched us before we reached the new but small uncomfortable two-roomed bungalow, 2½ miles from the Jelep, at Kapup (altitude 13,000 feet). All Sikkim bungalows have beds and accommodation for four travellers. It is strange

that this *new* bungalow should have only two small rooms and two beds, a very weak link in a chain of excellent rest-houses.

A mile or so past Gnatong begins the very steep rough causeway which runs down the side of Mount Lingtu to Sedongchen. In a few days we reached Rikyisum, a beautifully situated bungalow with a glorious view of the snows, 12 miles from Kalimpong, and here ended the best short holiday we have had in India.

POPULATION CHANGES IN THE EASTERN PART OF THE SOUTH WALES COALFIELD

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THE eastern portion of the South Wales coalfield, including parts of Glamorganshire and Monmouthshire, has developed during the past century from an almost exclusively agricultural region into one of the busiest industrial regions in the country, the population of Glamorgan increasing from 70,879 in 1801 to 1,120,910 in 1911. This rapid development was at first due to the iron trade, and later to the expansion of the coal export trade. These were affected in a very striking manner by the facts of mineral distribution, but also by the relief and the facilities for communications. These factors have exercised a marked influence on the rate of development of the various parts of the area, causing remarkable difference in the population even in adjoining parishes, so that while the district dealt with is generally considered to be a densely populated industrial region, several agricultural areas of scanty population also occur. It will be convenient to consider first the leading geographical factors which have influenced the changes in population, the development of the district will then be best treated historically.

The district represented on the map (Fig. 1)* falls naturally into two divisions, the coalfield on the north (*Blaenau Morganwg*), and the area outside the coalfield on the south (*Bro Morganwg*). The coalfield consists of a plateau of Pennant Sandstone, reaching to an average height of 800 feet in the south and 1500 feet in the north, deeply trenched by the parallel valleys of the rivers Rhondda, Cynon, Taff, Rhymney, Sirhowy and Ebbw.† The southern rim of the coalfield is marked by several escarpments through which the rivers have cut steep-sided gorges, like those of the Taff at Tongwynlais, the Rhymney at Machen, and the Ebbw at Risca.‡ Before the development of the coal and iron trades, the

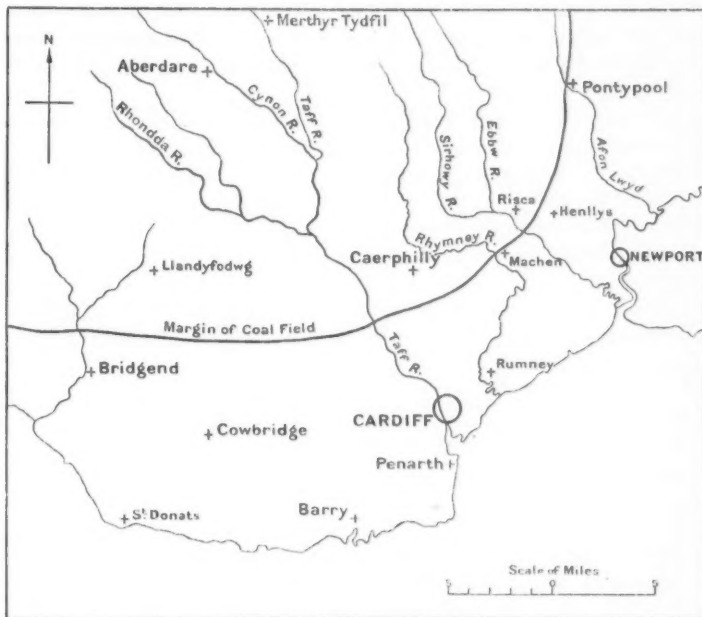
* This district is included in sheets 248, 249, 262 and 263 (1-inch) of the Ordnance Survey.

† A. Strahan, "On the Origin of the River-system of South Wales," *Q.J.G.S.*, vol. 58 (1902), p. 207.

‡ See F. Dixey and T. F. Sibly in *Q.J.G.S.*, vol. 73 (1918), plate 13.

population of the coalfield was very scanty, and consisted of farmers living on the high ground away from the often marshy valleys; the coalfield district was then referred to as "the hills," but since modern development has tended to concentrate the people near the rivers and communications, the coalfield towns are now called "the valleys." The southern region, the western part of which is called the "Vale" of Glamorgan, is an area of varied relief, rising in many places above the 400-foot contour, and often terminating at the coast in low cliffs.

The geology of the South Wales coalfield is fully described in the



1. The South Wales Coalfield

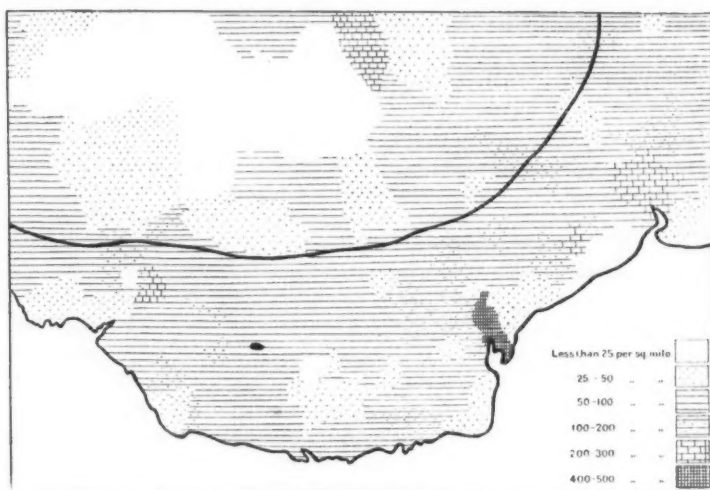
Memoirs of the Geological Survey,* where it is shown that the geology and relief are closely related. The "Vale" consists of Liassic limestones and shales, Keuper Marls of the Trias, with high ground of Carboniferous limestones and occasional patches of Old Red Sandstone.† On the north of the "Vale" the coalfield edge is marked by several parallel escarpments, formed by three belts of hard rocks, namely a conglomerate in the Old Red Sandstone, the Carboniferous Limestone series, and the Pennant Grit.

* A. Strahan and others, "The South Wales Coalfield" (*Memoirs of the Geol. Survey*), 1899 and onwards.

† A useful summary of the geology of the area is given by Dr. Strahan in 'Geology in the Field' (1910), p. 826.

These rocks forming this high rim of the coalfield dip steeply towards the north, and form the southern crop of the shallow syncline which constitutes the South Wales coalfield. On the north the dip is much gentler than on the south. Within the coalfield the greater part of the area is made up of Pennant Grit, which forms the high ground of the plateau, the lower Coal Measures outcropping along the sides of the steep valleys. A smaller anticline within the coalfield syncline has the effect of keeping the Coal Measures within workable distance of the surface.

The varied rocks of the vale yield soils of varying fertility, the Lias shales being mostly pasture land, the Carboniferous Limestone frequently wooded, while soils of the Keuper Marls and Old Red Sandstones were formerly used largely for wheat-growing. Since over most of the coalfield



2. Density of Population 1801

Pennant Grit is at the surface there has never been much likelihood of agricultural development, though the comparatively small areas of Coal Measure shales and some small patches of boulder-clay yield a more fertile soil where some crops, chiefly oats, are produced.

These facts determined the distribution of population in South Wales before the industrial revolution; the vale was then an important agricultural region producing a considerable quantity of wheat, but the relatively barren hills were mainly devoted to pasture. Many of the coalfield towns were then nothing more than shepherds' hamlets. The chief industries were connected with agriculture; the manufacture of woollen goods was important, sometimes being carried on in small factories as at Caerphilly, but more usually in sheds attached to the farms. At the

present time practically sixty-six per cent. of Glamorganshire is either moorland (the Pennant plateau) or devoted to grassland.

A hundred years ago, therefore, the population of the Vale was much more dense than that of the hills; this is well shown by the parish maps of the district, the parishes of the coalfield having an average area of 3600 acres, while those of the Vale are little more than half that area, notwithstanding that many of the coalfield parishes have been subdivided during the last century.

The population at the time of the first census, in 1801, illustrates the same fact, for while most of the parishes in the vale had a density of more than fifty per square mile, large areas of the western part of the coalfield had less than twenty-five per square mile.

Before this time, however, the iron trade had begun to develop in the coalfield. The ore chiefly worked was the ironstone nodules found interbedded with the Coal Measures, principally those of the lower series. At first these nodules were obtained from stream-beds, later by quarrying or "scouring," and finally by levels driven into the sides of the hills. The earliest smelting hearths or "bloomeries" were worked by wind, and were placed on the hills, but as the industry developed furnaces were built and water-power was used to work the bellows, so that the industrial population was drawn into the valleys.* The ores were mined more frequently on the north crop than on the south, because of the gentler dip, and more frequently in the east than in the west, because the ores are richer in the east; thus the iron industry became centred in the north-eastern valleys, and although the conditions which determined its position do not now obtain—the local ores being no longer used, owing to the importation of Spanish hæmatite—the industry has retained its centre. There is, however, some tendency at present to establish ironworks nearer the ports and so save transport.

The population was denser in the north-eastern part of the coalfield, Merthyr Tydfil having already become by the beginning of the nineteenth century the chief iron town. One of the first improvements was the construction of roads along the valleys to replace the tracks across the hills that had formerly been used. The roads were later followed by canals, one from Merthyr to Cardiff opened in 1798, and another from Newport to Pontypool. These canals largely affected development in the area, and led to the growth of export both of iron and coal, and thus to the opening of docks at Newport and Cardiff. Prior to 1800 coal was brought to Cardiff from Tenby, but by 1839 211,200 tons were brought by canal from the coalfield to the north. Coal was also exported from Newport to Ireland and Bristol; the increase in the export trade consequent on the making of the Monmouthshire canal is shown in the following table:

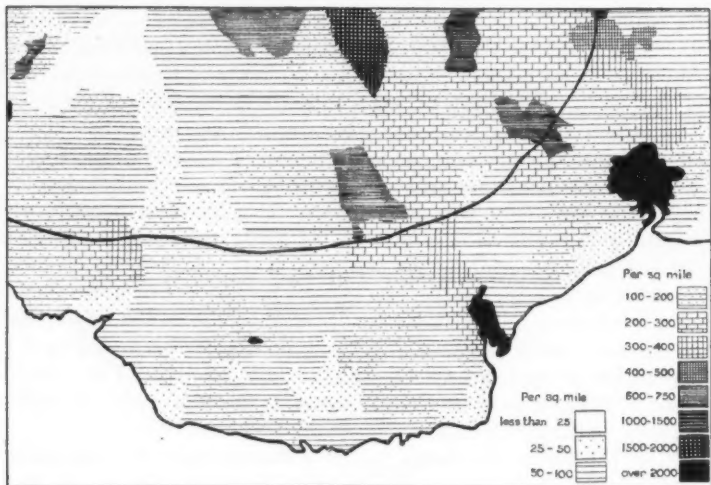
* See J. Wilkins, 'The History of the Iron, Steel, Tinplate, and other trades of Wales' (Merthyr, 1903).

Export of Coal from Newport, 1798 to 1809.*

1798	...	...	9,715 tons	1804	...	...	64,393 tons
1799	...	...	18,375 "	1805	...	...	73,823 "
1800	...	...	32,277 "	1806	...	...	89,129 "
1801	...	...	29,981 "	1807	...	...	109,648 "
1802	...	...	32,843 "	1808	...	...	132,316 "
1803	...	...	36,219 "	1809	...	...	148,019 "

Previous to the Industrial Revolution wood was used in smelting, and by the middle of the eighteenth century almost all the eastern part of the coalfield was deforested; the continuance of the iron trade in the district was made possible only by the substitution of coal for charcoal.

The coal was not only worked for smelting, but shortly afterwards became used to a greater extent for fuel. The coals of South Wales are



3. Density of Population 1851

unusual, since as each seam is traced north-westwards it becomes less bituminous, so that while the coals of the south-east are not very different from those of other British coalfields, the steam coals nearer to the north-west are more anthracitic.† The exportation of these smokeless coals to London commenced about 1830, the earliest valleys to be developed being Merthyr and Aberdare, the Rhondda Valleys becoming important at a later date.‡

The map of the density of population in 1851 shows the changes caused by these developments. In the Vale of Glamorgan generally

* A. Bassett, "Port of Newport," etc. (*Proc. S. Wales Inst. Engin.*), vol. 5 (1867).

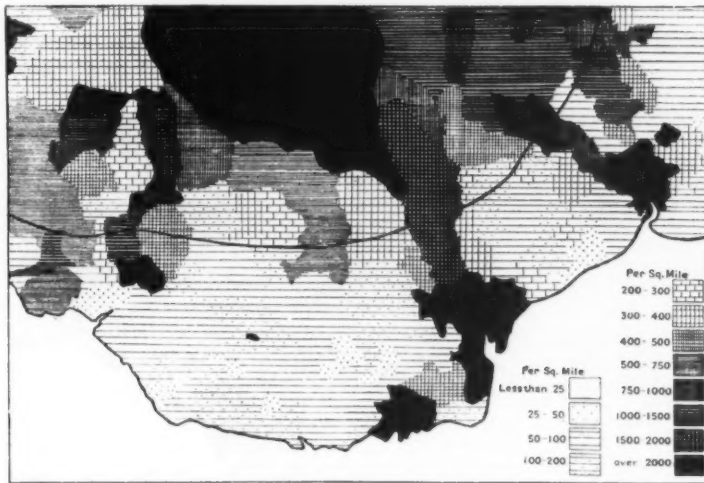
† A. Strahan and W. Pollard, 'Coals of South Wales' (*Mem. Geol. Survey*), 1908 (2nd edit., 1915).

‡ H. Wilkins, 'The South Wales Coal Trade' (1888).

there are few changes, but the coalfield parishes almost without exception are denser than in 1801. Merthyr, Aberdare, Bedwelty and other places have a population of over 500 to a square mile, while some of the western valleys have also developed, but more slowly. The lines of denser population along the Taff Valley (Merthyr Canal) and the Ebbw Valley should be noticed.

Meanwhile, Cardiff and Newport developed as coal ports consequent on the improved communications—Newport, from its proximity to the eastern valleys, which were the first to be opened up, at first progressing more rapidly than Cardiff.

About this time the railways were constructed; these naturally followed the valleys and tended still further to concentrate the population there;



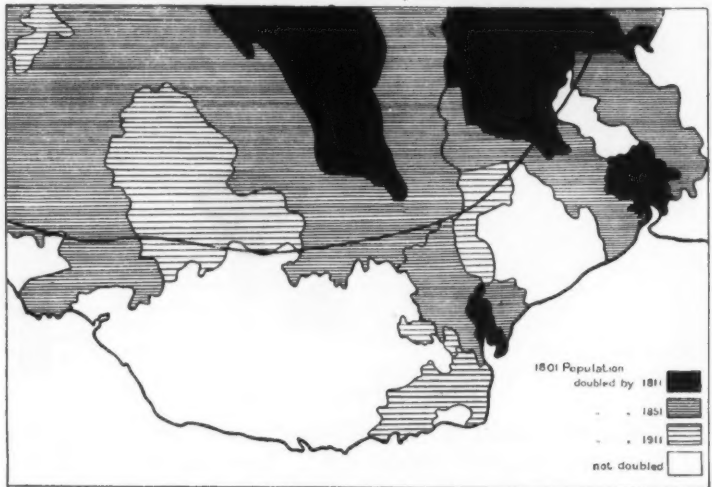
4. Density of Population 1911

they entered the coalfield, as did all previous lines of communication, by the gaps in the escarpments noticed above. Some later railways, as the Rhymney Railway at Cefn On, shorten their routes by tunnelling through the escarpment, while the more recent Barry Railway is still less dependent on relief. While the railways have proved to be unusually important factors in the development of the coalfield valleys, their effect in the agricultural district of the south has been somewhat similar to the effect of railways in England generally, a point which is well shown by the difference in rates of development of Cowbridge and Bridgend; the former town was a leading agricultural centre of the vale before 1801, but its population has scarcely increased during the century, while Bridgend, formerly of much less importance, has on account of its position on the main railway now become the chief town in that region.

The continued development of the coal and iron (or steel) trades, the improvement of communications, and the need for further export facilities, are responsible for the changes in density of population revealed by the last census of 1911. The coalfield parishes are now very much denser than those of the Vale, which show few changes during the century. The Rhondda Valleys have become one of the densest parts of the coalfield, having increased because of their export of steam coal more rapidly than the valleys further east, which developed earlier. It is interesting to notice the increase in population along the main lines of communication—the Taff Valley to Cardiff, the Ebbw Valley from Risca to Newport, and the Afon Lwyd from Pontypool to Newport. The new ports at Penarth and Barry also have entirely developed within this period.

Population Changes 1801-1911.

A new way of representing population changes during the century is shown in Fig. 5. In illustrating changes during a given period it is usual



5. Order of Development of Parishes since 1801

to show the percentage increase, but in this figure an attempt is made to show the order of development of the various areas. The black lines bounding the areas indicate equal time of development; the shading is designed to emphasize those parishes which developed most quickly, the indication of development used being the time when the 1801 population was doubled. From this it is clear that the whole of the coalfield has at least doubled its population during the century, the earliest parts to develop being the eastern valleys and the valley between Merthyr and

Cardiff, that is, the regions along the canals. The latest coalfield parishes to develop were those in the west of the area represented on the map, with less facilities for easy communication. In the "Vale" are several areas where there has been no marked increase, the only exceptions being first Newport and Cardiff, later, their suburbs, and more recently Penarth and Barry. This map shows clearly, too, the increase in population along the valleys leading from the coalfield; compare, for instance, the population of the lower Ebbw and the Afon Lwyd valleys with the parishes on the high ground between, as at Henllys, where there has been little increase.

Considering the percentage increase of population in the parishes during the century, the parishes fall into several distinct groups, the chief of which are:

1. The agricultural parishes, some few of which remained fairly constant (Goldcliff), while others show a more or less marked decrease during the century (St. Donats). The number of farm workers in the area shows a decided decrease during the century; in 1851, 12,721 males were engaged in agriculture in Glamorgan, but this had fallen to 9489 in 1911.

2. Other parishes in the Vale showing rapid increases throughout the century consequent on their growth as export towns, such as Newport and Cardiff.

3. The parishes of the "Vale" which, at first agricultural, behaved like Group 1, then became involved in the growth of other centres as suburbs of Cardiff (Rumney), or were made into ports; note that until 1881 the Barry population was only about a hundred, increasing suddenly to over 13,000 during the following ten years, when the dock was made, one of the most remarkable increases in population to be found in this country.

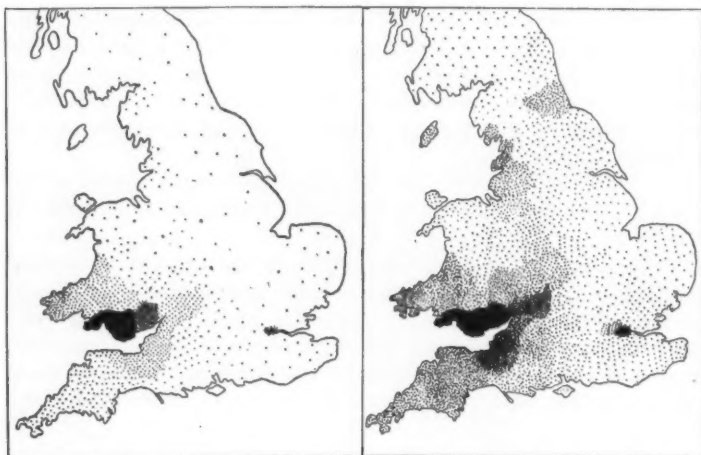
4. The coalfield parishes, generally increasing steadily, often doubling their population every ten years, the time of development depending on the accessibility of the coal and the means of transport. Compare, for instance, Aberdare with the more western parish of Llandyfodwg, in which the population at first decreased owing to the migration towards the parishes where development occurred earlier.

The great increase in population of the coalfield parishes and of the coal ports, although accompanied by a decrease in the agricultural population of the neighbouring Vale, is clearly by no means balanced by it, and can only be accounted for by a considerable immigration. A method of representing this immigration is illustrated in Fig. 6. In the census returns the county of birth of the inhabitants of the various county-boroughs and urban districts is given, and Fig. 6 represents the birth-places of the Cardiff populations of 1851 and 1911, one dot having been placed in any county for every ten Cardiff residents who were born in it. A comparison of the two maps is interesting; the migration previous to

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1851 was in the main independent of railways, and most of the people came from the agricultural counties of South Wales and south-west England. As very few of those immigrants would live until 1911, the second map shows the immigration as affected by railways, considerable numbers being attracted from distant counties. Of the 182,259 people in Cardiff in 1911, 94,380, or a little over one-half, were born in the city, and only about one-sixth of the immigrants came from Glamorganshire. Of the rest 9 per cent. came from the other counties of South Wales, a similar number from Monmouthshire, over 10 per cent. from Somersetshire, and 11 per cent. from Gloucestershire.

Similar maps constructed for Merthyr Tydfil illustrate the fact that a larger proportion of the population of this town was drawn from neigh-



6. County of Birth of Immigrants into Cardiff: one dot represents ten persons born in any county

bouring agricultural communities, 25 per cent. of the immigrants coming from Glamorganshire, and 33 per cent. of the remainder from other counties of South Wales.

The people who went into the coalfield were mainly young unmarried men, and as a result we find that in the coalfield parishes the number of males greatly exceeds the number of females; note this especially in the districts which have most recently developed as did the Rhondda Valley, where the females only number about 84 per cent. of the males. In the parishes outside the coalfield the reverse is the case, the proportion of males to females being more normal.

It should be pointed out that the actual density of the population is much greater than appears from the maps, for in no cases are the people of the coalfield spread out over the parish, the towns having grown almost

entirely in the narrow valleys, the remainder of the parish being almost uninhabited. The effects of this overcrowding on the social conditions are admirably discussed in the Report of the Commission of Inquiry into Industrial Unrest in South Wales and Monmouthshire (Cd. 8668 [1917]). The crowded population of the previously deserted marshy valleys is in marked contrast with the bare hills, untenanted save by shepherds and a few farmers, with their old cottages clustered round the ancient parish church, relics of the agricultural days overlooking the modern developments of the industrial valleys.

While there are certain characteristics common to the development of all our coalfields during the past century, there are several points in which South Wales is unusual. In many British coalfields the Coal Measures dip under newer rocks,* and there is a tendency for the population to extend from the exposed to the hidden coalfield. This cannot occur in South Wales, for on account of its structure there is no hidden coalfield, and the mining population is concentrated within the synclinal area. Further, the occurrence in the Coal Measures of South Wales of a massive sandstone series, the Pennant Grit, gives to this coalfield unusual physical features, and makes a normal development of coalfield towns impossible, leading to the crowded conditions of the valleys. The greater value of the steam coals is not only an important factor in modern life in South Wales, but has also been responsible for the rapid migration into the area, for whereas the coalfields of the Midlands and the north of England were not far distant from areas of comparatively dense agricultural population from which workers were attracted, only abnormally high wages could serve to attract them to the more distant coalfield of South Wales, and but for the quality of the coal this coalfield probably would have been later in developing.

REVIEWS

EUROPE

Les Frontières Historiques de la Serbie.— Gaston Gravier, Lecteur à l'Université de Belgrade. Introduction de Émile Haumont, Professeur-adjoint à la Faculté des Lettres de Paris. Avec 3 cartes dans le texte et 3 cartes hors texte. Paris: Armand Colin. 1919. *Price 4 fr.*

THE name of Gaston Gravier is familiar to students of the Balkan area as that of a young French geographer who, thanks to his position at the University of Belgrade, had opportunities of studying the region at first-hand, and before the war had published various papers on some of its problems. The present pamphlet was written by him as a supplementary thesis for the French degree of doctor of letters, apparently during 1913 and the early part of 1914. It had been accepted at the Sorbonne, subject to certain minor modifications, which its author proposed to make during the summer

* B. C. Wallis, "Nottinghamshire in the Nineteenth Century," *G. J.*, vol. 43 (1914), p. 50.

vacation of 1914, prior to his return to Belgrade. On August 2, however, he was mobilized in the French army, took part in the fighting round Nancy in 1914, and after transference to the northern front was killed in the fighting near the sugar refinery of Souchez on 10 June 1915. His pamphlet has been issued by his French and Serbian friends, not only as a memorial of its author, but in the hope that, despite all the changes which have occurred in the situation since, it still has a mission to fulfil. Written before the war, and published with only those changes which its author had already made in the proofs, its standpoint is naturally very different from that of more recent publications, but this fact gives it a dispassionateness and scientific detachment which it is now difficult to obtain.

The booklet consists of five chapters. In the first we have an excellent brief account of the geographical framework in which the modern state of Serbia is set. The second summarizes the survivals of the Serbia of the past which persisted, alike in administrative divisions and in the minds of men, during the period of eclipse under Turkish rule. The main stages in the growth of the modern state are considered in the three following chapters, that is, the resurrection in the period from 1804 to 1815; the enlargement due to the accession of the six districts in 1833; and finally the changes produced by the treaty of Berlin in 1878 both within Serbia and in the peninsula generally. Finally, under the heading of conclusion, a few pages are devoted to the effects of the wars of 1912-13, regarded by the author at the time of writing as too recent for full discussion.

Despite the title the book is written rather from the geographical than from the historical standpoint, the main thesis being that the growth of Serbia since the rise of the modern state has been an outcome of the geographical conditions, though the actual series of changes has necessarily been influenced by the trends of external policy, especially the rivalries of the Austrian and Russian empires. At the outset of the insurrection of 1804 the insurgents of the pashalik of Belgrade had no conscious purpose in view save the amelioration of conditions which had become intolerable. With their first successes, however, their slumbering but not extinct national feeling awoke, and its rise was assisted by the influence of the Austrian Serbs, especially by that of the orthodox priests. Thereafter, through all the vicissitudes of fortune, the driving force, in M. Gravier's opinion, was the desire to extend southward along the Morava-Vardar line, the line marked out by the topography of the country, and to achieve that connection with the sea which alone could make complete economic and political independence possible. In his last paragraphs he points out that in 1913 Serbia had practically succeeded in attaining her mediæval limits, so that the desire for the reconquest of lost territories within the Balkan area was virtually satisfied. But he makes clear that with the accomplishment of their territorial aims within the peninsula the eyes of the Serbs were being turned to the "new Turkey" of the north, which held their brethren in bondage as the Turk had formerly held them in bondage within the confines of mediæval Serbia. With this desire went also that for the complete achievement of the connection with the sea. But there is nothing in the pamphlet to suggest that its author anticipated that Austria-Hungary, with a full appreciation of the trend of events in Serbia, would fling Europe ruthlessly into war in order to finish once for all with that little state.

The book, especially on account of its sober, scientific standpoint, and its complete detachment from all the new difficulties which now surge round the Balkan area, is worthy of special attention at the present time.

M. I. N.

ASIA

The Turkes of Central Asia: in History and at the Present Day.— M. A. Czaplicka. Oxford: Clarendon Press. 1918. 15s. net.

Those who provide for us, on a subject such as this, information that is new, or who bring such information as already exists within easier reach—and Miss Czaplicka does both—deserve our gratitude even when their work is avowedly imperfect and, in some respects, little better than makeshift, a fact we lay stress on here for the reason that in what follows the critical somewhat largely out-bulks the merely appreciative. The volume before us—242 pages in all—is divided into two halves, the first being devoted to “An ethnographical enquiry into the Pan-Turanian problem”; the second, to “Bibliographical Material relating to the Early Turks and the Present Turks of Central Asia.” In an Appendix (A) Miss Czaplicka deals briefly with the results of the war as regards Turkey in Asia, and if it be true that the Pan-Turanian problem “will remain one of the burning questions long after the peace settlement is achieved in Europe and Asia,” the collocation of this vast apparatus of learning with what many have deemed a mere question of the day may prove to have been fully justified. The purely artificial nature of this movement is, however, not difficult to prove, and, for our own part, we are not greatly impressed by its chances of ultimate success. Miss Czaplicka herself tells us that the Turkic nations she has met in Asia “would be surprised if any one proposed to unite them in one local group on the ground of some remote tradition”; and, presumably, they would open their eyes still wider at the idea of being affiliated to the Osmanli, with their surplusage of foreign blood and foreign culture and their linguistic divergences.

In the division of the Turkic-speaking peoples on p. 20 some slip seems to have occurred. “The term Eastern Turks,” we are told, “is used to embrace the people of Turkestan and Central Asia as far as Mongolia and China.” This would exclude the Siberian Tartars as well as the Yakuts, which, of course, is not intended (see pp. 47, 51 *sq.*). It is with the first of these groups that Miss Czaplicka is best acquainted, and what she has to tell us of them is full of interest. Incidentally, one is glad to hear that, since the Russian revolution, Siberian scholars and public men have taken in hand the protection of the Uriankhai, who were being driven from their territory wholesale by Russian colonists. The second half of the book is claimed—and for all we know rightly—as the first attempt at dealing (broadly) with the bibliography of the subject. It gives the titles of several hundreds of books and articles, a large number of them in Russian; and it is undoubtedly something to be thankful for. But it is a mere sketch of that complete bibliography which may one day be forthcoming, and why not from the industrious hands of Miss Czaplicka herself?—though, in regard both to “Enquiry” and “Bibliographical Materials,” we are tempted to question the wisdom, in the present state of human science, of any attempt to pursue the matter further. For, as all these who have had even slight occasion to deal with it know, there is not one single race or nation, of the many to whom the term is or has been applied, of which it can be affirmed with any degree of certainty that it is Turkic in blood, and Turkic only. Huns, Magyars, Avars, Khazars, Pechenegs, Bulgarians, Polovtsi, even Mongols and others, have all been called Turks, may all, indeed, have had, or still have, more or less of Turkic blood in their veins; but as to the purity of that notable ichor, who nowadays would dare to dogmatize? Howorth was strongly inclined to think Chenghis himself more than half a Turk, and we ourselves are like-minded; the Torguts, an important branch of the Kalmuks, derive, by their own traditions and belief, from the Kerait chief Ung-Khan, otherwise

Prester-John ; and the problems hereby suggested are samples only of a well-nigh endless series. The theme is too large and intricate to be pursued here, but a hint as to one prime difficulty may be taken from Miss Czaplicka's own statement that in the Turkomans the Iranian type predominates, and not only in culture but in physique. We are told, indeed, that they are endogamous, and it is suggested that their endogamy has for its object the preservation of the purity of the race ; but the admission that they are physically Iranians, coupled with the known fact that they were for centuries in the habit of raiding Persian territory and carrying off Persian women, points infallibly to a strong infusion of Persian blood, and similar causes operate in numberless other cases to stultify the ethnologist's utmost endeavours. It is to be feared, indeed, that we shall never get on terms with this race difficulty until the super-chemist of the future is enabled, by some hitherto undreamt of analytical procedure, to distinguish the racial admixtures in the human blood, bone, and tissue, and apportion accurately their varying quantities. Meantime, the doors open so widely, on a vista so endless, that the boldest inquirers may well be daunted, and that is why our encouragement to Miss Czaplicka to proceed is tinged with no little compunction.

A section on archaeology opens up a fascinating branch of inquiry, but here again we want more definite knowledge. One pregnant fact, not mentioned by our authoress, is that of late years tin has been found in the Altai region, and old tin-workings with bronze tools in them—a fact to be ruminated deeply in connection with her statement that "it is not the Scythian bronze that influenced Minusinsk bronze, but rather the reverse." It may be hoped that *Kurgans* still exist, hidden in the recesses of the *taiga*, untouched by the Russian treasure-seekers of the past three centuries, and that from them we may some day learn more on this truly fascinating subject.

Miss Czaplicka is so modest as to the merits of her present attempt that criticism of her bibliography can best take the form of suggested emendations or improvements. In it we note some serious omissions. Thus, under "Asiatic Russia" no mention is made of the important atlas to which the book in question supplies the text. Herberstein's work, originally printed in Latin in 1549, is given in its modern English dress only ; we fail to find G. F. Müller's 'Sibirische Geschichte,' from which J. E. Fischer's work under the same title (here entered) was mainly stolen word for word ; nor do we meet the name of Dr. Josef Szinnyei, a Hungarian ethnologist, by whom shrewd blows have been dealt at the time-honoured term "Ural-Altai," accepted without hesitation by the authoress. Misprints, too, and other minor errors, are not infrequent. The statement (p. 91) that certain people "buried their dead on a high platform" suggests a query, as does the reference to "spherical" tents (p. 104). It is somewhat puzzling to be told of "Kuchum with his Kaisak[s]" (p. 76), for though we read of Uzbek Kazaks in the fifteenth century, the two names were pretty well separated by the middle of the sixteenth. Now, Kuchum was an Uzbek, a Sheibanid, of the *Mavera-en-nehr*, and whatever his relationship to the Kaisaks (or Kazaks), his attitude towards them seems to have been purely hostile. As to Witsen (p. 80), the famous burgomaster of Amsterdam, we can assure Miss Czaplicka that he was in Asia neither in 1692 nor in any other year of his life.

Transliteration from the Russian is no doubt a thorny subject, but we cannot pass without protest certain usages (Kotwicz for Kotvich, Przewalski for Prjevalski, and the like), into some of which perhaps Miss Czaplicka has been betrayed by her Polish connections. Polish forms, even of names of Polish

origin, are surely out of place in an English version of the titles of books written and printed in Russian.

J. F. B.

AMERICA

South America: an Industrial and Commercial Field.— W. H. Koebel.

London: T. Fisher Unwin. 1918. *Illustrations.* 7s. net.

This volume is one of the well-known series dealing with the South American Republics, published by T. Fisher Unwin. It is compiled by Mr. W. H. Koebel, who has already been responsible for the volumes dealing with Uruguay, Paraguay, and Central America. The word "compiled" is used advisedly, as it is almost impossible for any one person to have an intimate knowledge of all South American trade and commerce. Mr. Koebel has himself realized the difficulties and pitfalls involved in the attempt to comprise a subject of such wide scope within the limits of a single volume of 300 to 400 pages of fairly large type. The first edition of the book was published in 1918, and its outlook was necessarily influenced by war conditions. Mr. Koebel sees the possibility of commercial and industrial "war," and proceeds to instruct his readers as to the point of view and methods of business most popular in Latin-American countries. In his usual easy style he calls attention to the vast areas to be covered, and the good work which has been done by British capital in assisting communications so far.

The first or preliminary half of the book is of a general nature. Mr. Koebel then attempts to feed us with a series of comparative statistics showing the trade enjoyed in the different South American Republics by the importing and exporting nations. We confess to some doubt as to the trustworthiness of most South American statistics, and, indeed, the difficulty of getting these up to date has compelled Mr. Koebel to fix a pre-war limit of 1913 for most of them. Other figures, such as those relating to the Development of Argentine Agriculture, the estimated Cattle-stocks in the world, etc., are more or less stimulating reading, but here again the figures given are open to question; such, for instance, as the thirty-one million odd sheep and goats reputed to exist in Asiatic Russia. There is a chapter on Currency, Weights and Measures, and a final chapter on the Rival Powers, *i.e.* those nations who are engaged in the commercial war earlier referred to, with especial reference to German penetration.

It is a question whether any volume of this comprehensive character and limited extent can be of practical assistance to those who already know the country and are engaged in trade in it. Nevertheless it may afford useful reading to those who have not so far tackled the South American field, and who would like to glean some general information before adopting the only wise method, namely that of going there and finding out for themselves.

W. S. B.

GENERAL

Seaways of the Empire.— A. J. Sargent. London: A. & C. Black. 1918.

Pp. xii., 171. *Maps.* 7s. 6d.

Here is a serious piece of geographical research, approached under the statistical and economic aspect. The writer, basing his book on a series of lectures, points out that he deals only with a small portion of the whole problem of the geography of commodities, to wit, the geographical and economic conditions of transport by sea. Successive chapters are concerned, on this basis, with Australasia, with India and the Far East, with Suez and Panama, with North and South America, with the Mediterranean and the Black Sea,

and with the North Sea and the Baltic; and an excellent endeavour is made, within the limits of black-and-white maps, to illustrate what the route-chart habitually fails to make clear—"the real volume of goods carried over the routes." The author has not been best served by his draughtsman, nor is the presentation of figures in his text self-explanatory to the uninitiated. But the uninitiated may be recommended to initiate himself, for he will not readily find elsewhere so clear an exposition of the seaways of the empire. He may superpose, if he choose, the romance and the common interests of the subject. The author's business is with its framework and little else: he offers some apology for his handling of complicated groups of figures under the pressure of war conditions, but indeed no apology is necessary; he has carried the subject a long step further on geographical lines than most students would be qualified or would endure to carry it. And the extraordinary labour must be recognized of bringing order out of the chaos of statistics presented by all manner of methods and in all stages of incompleteness—such, for instance, as the author indicates in dealing with the important question of the relative use made of the routes between this country and Australasia, when he arrives at somewhat different results from those set out by the Dominions Royal Commission.

The effects of the war upon shipping are deliberately and rightly ignored. In peace, it must flow back into something like its old channels, so that the book really appears at an appropriate moment. On the other hand, the author, having shown very clearly "the development and organization of trade routes on the basis of coal, whether as a driving force for the ship or as a useful cargo with which to fill up on the outward voyage from the United Kingdom," concludes with a suggestive indication of possible changes of conditions affecting routes, arising from limitation of the distribution of British coal, and extension of the use of oil, in the future.

O. J. R. H.

THE MONTHLY RECORD

THE SOCIETY

Medals and Awards, 1919.

The Royal Medals have, with the approval of His Majesty the King, been awarded by the Council as follows:

The Founder's Medal to Colonel E. M. Jack, C.M.G., D.S.O., General Staff, for his geographical work on the Western Front.

The Patron's Medal to Prof. William Morris Davis, of Harvard University, for his eminence in the development of Physical Geography.

The Victoria Medal to Prof. J. W. Gregory, F.R.S., of Glasgow University, for his many and important contributions to geographical science.

The other Awards are as follows:

The Murchison Grant to Dr. W. M. Strong, of the North-Eastern District, Papua, for his journeys and surveys in New Guinea.

The Back Grant to the Venerable Archdeacon Stuck, of Fort Yukon, for his travels in Alaska and ascent of Mount McKinley.

The Cuthbert Peek Grant to Prof. Rudmose Brown, of Sheffield University, for his geographical work in the Antarctic and in Spitsbergen.

The Gill Memorial to Mr. J. W. Harding King, for his investigations of desert conditions in Northern Africa.

EUROPE

The Rhine as an International Waterway.

One of the subjects calling for consideration by the representatives of the Powers now assembled at Paris is that of the future status of the Rhine as a waterway, which is bound to be modified by recent events. A movement has been for some time on foot at Basel aiming at the improvement of the navigation on the upper river so as to make of that Swiss city the real head of water transport from the sea. In conjunction with other bodies with similar objects, the *Verein für die Schifffahrt auf dem Oberrhein* publishes a serial entitled "Die Rheinquellen," devoted to the objects in view. In the number for October-December 1918 (XIII. Jahrg. No. 10-12) Dr. R. Gelpke (member for Basel in the Swiss National Council and Chairman of a Parliamentary Commission on inland navigation) discusses the possibilities of the Rhine as a waterway in two papers, the first from the general point of view of communication between London and Basel by this route, the second with more special regard to the supply of Switzerland with coal. The writer expresses the hope that the coming peace will place the Rhine for the first time in the position of a free waterway, from the use of which as a connecting link between Great Britain and Switzerland he anticipates great results. Local interests in the Upper Rhine region have greatly obstructed free navigation in the past, but he hopes that such obstacles will now be removed. Hitherto the direct participation of this country in Rhine navigation has been virtually nil. Of the vessels which passed the Dutch-German frontier in 1913 65·1 per cent. were Dutch, 20·3 per cent. German, 14·4 per cent. Belgian, and only 0·1 per cent. British; and whereas the tonnage of Rotterdam amounted to over 22,000,000 and of Antwerp to about 4,000,000, that of British ports was only 88,000. Already steps have been taken to improve the navigation at low water between Cologne and Strassburg, and it only needs the extension of similar work between Strassburg and Basel to provide a waterway navigable by sea-going vessels to the Swiss frontier, and thus for the first time to give Switzerland an unfettered access to the ocean. Of a total distance of 735 miles from London to Basel only 136 are on the open sea, and the writer looks forward to a vast extension of trade between Great Britain and Switzerland (hitherto restricted to the lighter and more costly articles) by this route. He emphasizes the extent to which British interests are involved, and says that with proper measures London would become more and more the distributing centre of the world's products for the whole of Central Europe. It is no doubt an attractive prospect, though one may question whether quite enough weight is given to the competition of Rotterdam and Antwerp. It will be remembered too that the opening of a southern outlet *via* Geneva has found greater favour in some circles, as a means of counterbalancing the undue dependence of Switzerland on her northern neighbour. But recent events have no doubt lessened the force of such considerations. We understand from Dr. A. L. Vischer, by whom we have been favoured with a copy of the paper, that M. Gelpke has been able to submit these questions to the Paris Conference as a representative of the Swiss Government.

ASIA

Routes across the Syrian Desert.

Captain T. C. Fowle writes to us from Meshed in reference to Mr. Carruthers' paper in the *Journal* for September last on the old Desert Caravan route from Aleppo to Basra, pointing out that there is no regular caravan route from Abu Kemal on the Euphrates to Palmyra as is indicated on the map accompanying the paper, and indeed on many other maps. The route was traversed by Captain Fowle in 1910, as described in his book 'Travels in the Middle East' (1916). As a matter of fact, Captain Fowle says, caravans never travel by it. It is just like the rest of the desert in those parts with a few wells here and there which provide enough water for the Bedouin who roam over it. A parallel route some 25 miles to the south was followed by Colonel Chesney in 1830, and the same tract of country was twice traversed, in a north and south direction, by Musil in 1908.

AFRICA.

Prize Law on the African Lakes.

The naval operations against enemy craft on Lake Tanganyika and the Victoria Nyanza raised questions of international law, the answer to which was not at once obvious owing to the absence of a clear understanding of the status of such inland waters in the matter of prize captures. On both lakes the German vessels afloat were captured or destroyed by British naval craft, and application for their condemnation as prize was successfully made in both cases before the British Prize Court. On Tanganyika the German vessel *Kingani* was first captured by the British launches *Mimi* and *Toulou*, and after repair was incorporated into H.M. Navy and took part in the destruction of the *Hedwig von Wissmann*. When brought before the Prize Court the matter resulted in the award of prize bounty by the late President, Sir Samuel Evans, but the question whether craft captured upon an inland lake are subjects of prize was not considered by him. In regard to the captures on the Victoria Nyanza (made by British trading steamers, the largest of 1146 tons, commissioned and armed by the Admiralty), the question was fully considered by his successor, Lord Sterndale, whose judgment is of interest as a review of the whole question, which is now placed on a definite footing. Whereas *primâ facie* all enemy property is liable to seizure and condemnation, the liability has been to some extent limited by international law, and the question to be decided was whether the limitation excluded the case under discussion. Precedents showed that there is no general principle excluding captures on inland waters from the operation of the law of prize, and a consideration of the sea-like character of lakes like those of Africa and North America showed that the conditions were in no way analogous to those of captures in land warfare which have been excluded from the law. The principle so established is moreover supported to some extent by the authority of decisions in the case of the American lakes. It appears that prizes were made on these in the war of 1812 or earlier, at which date there was no direct access to the lakes from the ocean, so that the analogy with Tanganyika and the Victoria Nyanza was complete. As involving the position in international law of so important a feature of the Earth's surface the subject has a distinct concern for the geographer. We are indebted to the Right Hon. Lord Sterndale, President of the Admiralty Division, for copies of the above Judgments, which have been placed in the Library.

The Sudd Region as a Reservoir.

The completion of the great Aswan dam provided for the more pressing needs of Egypt of water for irrigation, but it has been shown that far more could be done to add to the cultivated area, both in Egypt and the Sudan, were a still greater supply available. Various irrigationists, including of course Sir W. Willcocks, have given attention to the matter, and both the Equatorial lakes and Lake Tana in Abyssinia have been considered as possible reservoirs. These however, at any rate the latter, have the disadvantage of lying outside the territory controlled by Egypt, and the possibilities of constructing a reservoir within the territory of the Egyptian Sudan have been carefully studied. The Egyptian Government accepted a proposal for a White Nile reservoir put forward by Sir W. Willcocks and Mr. Craig, but with modifications which in the former's opinion have "changed them from beneficent works which were for the joint benefit of Egypt and the White Nile valley into a scheme for wiping the White Nile province off the face of the Earth." The proposed dam at Gebel Aoli is to be of earth only, and as the reservoir is to be filled to the height of the highest floods, the consequences to Egypt of an accident to the dam would, in Sir W. Willcocks' view, be disastrous. He now favours a scheme for the utilization of the Sudd region, at a comparatively small cost and expenditure of time, as a reservoir capable of meeting the needs of Egypt for all time and those of the Sudan for many generations. In two papers, the first read at the Sultanieh Geographical Society in November 1918 with the collaboration of Mr. John Wells, the second before the Institute of Egypt in February of this year, he explains the special characters which, he thinks, seem to make the Sudd region "Nature's provision of perennial irrigation and flood protection for the whole of the Nile Valley." Chief among these is the much-abused water-vegetation, which has the effect of holding up the water so that its surface is nowhere horizontal but keeps at a slope as though congealed. On the right bank above the Maya Tavila and on the left below that point the flat plains set no limit to the extent of the overflow at high water, the river itself being at a higher level than the adjoining country. It is impounded by the dense vegetation, and it only needs a lowering of the river to enable a great part to return to the latter by gravitation. This, it is said, can be done with extraordinary effectiveness at two sites, where regulating heads could be constructed. The filtering action of the weeds obviates the risk of silting of the channels, and their presence also removes fear of destructive wave action. The works would include a series of banks directing the flow of the water towards the drain supplied by the Zeraf river. The principal gain would apparently be the reduction of loss by evaporation through the formation of separate basins, each in turn to be emptied before the next were drawn upon; for it does not seem to be contemplated to impound more of the flood-water than is stored at present by natural means. The scheme seems an attractive one, though the question suggests itself whether the action of the vegetation in maintaining a sloping surface would not unduly retard the outflow when the supply should be needed. This has no doubt been duly considered, though in so exceptional a region it must be difficult to entirely forecast the effects of tampering with the natural conditions.

AMERICA

The Norse Voyages to "Wineland."

The perennial problem of the early voyages of the Norsemen to North America *circa* A.D. 1000 has been once more taken up, this time by Prof. H. P.

Steensby of Copenhagen ('The Norsemen's route from Greenland to Wineland': Copenhagen, Henrik Keppels Forlag, 1918). While it is too much to expect that a final and decisive answer will ever be found to the question, there is no doubt that Prof. Steensby has gone the right way to work, and his conclusions are judicious and worthy of careful consideration. He is at pains throughout to put himself as far as possible in the place of the old voyagers, recognizing the limitations to which they were subject, and endeavouring to decide step by step the course which they would be most likely to adopt under the given conditions. He is acquainted with most at least of the voluminous literature on the subject, the only recent contribution to which he makes no reference being that of Mr. Babcock, noticed in the *Journal*, vol. 43, p. 194. He is one of those who hold that the accounts of the Sagas are in the main actual history, and not, as was suggested by Dr. Nansen, a combination of mediæval legends with a substratum of real Norse experiences. He regards as unassailable the position taken up by Storm as to the relative value of the sources, giving the principal weight throughout to Eric the Red's Saga. He has thus only two known voyages to deal with—the original discovery by Leif in 1000 and the re-discovery by Karlsefni in 1003-5. In tracing the latter's route he takes into consideration the geographical conditions—distribution of sea and land, currents, winds, and so on—as we know them, always remembering the different impressions the first navigators would gain in the total absence of maps and the limitation of their knowledge to what they could see from their low decks. He insists, too, on the importance of bearing in mind the *coasting* character of the navigation. These considerations lead him to a different result from his predecessors, who have brought the hardy navigators to some point in Newfoundland, Nova Scotia, or the eastern coast of the United States, whereas Prof. Steensby locates Wineland within the mouth of the St. Lawrence, just where the gulf becomes so narrowed as first to take the character of a river entrance. From the starting-point in South Greenland he finds it entirely in accord with natural conditions that Karlsefni should have followed the coast northward to the western settlement before striking across to the Labrador coast, which all are agreed in considering as Helluland ("Flat Stone Country"). Following this coast south to the Strait of Belle Isle, the voyagers would enter the latter, and would continue to follow the southern Labrador coast (Markland, or "land of trees") "towards the south-west," with Bjarney or Bear Island (northern Newfoundland) "to the south-east." On the continuation of this continental shore we have just such a coast as is indicated by the name Furdustrands—a monotonous stretch of sandy coast offering no attraction to the settler—and, further still, at the junction of the Fiord-like Saguenay with the St. Lawrence—both with the character rather of arms of the sea than ordinary rivers—we have the part of the coast "indented by fiords." Even the wintering place at Hop may be found at the modern St. Thomas, on the southern shore of the main river, where all or nearly all the details, physical and ethnological, agree well with those of the Saga. That the vine grew wild in this region, in old days at least, is shown by the name "Isle de Bacchus" given by Cartier, for this very reason, to the adjacent Isle d'Orléans. Without venturing to suggest that the question has been settled once for all, we may certainly allow that Prof. Steenstrup's solution involves perhaps fewer difficulties than any yet put forward.

GENERAL

Time-keeping at Sea.

It will be remembered that at the Conference held in 1917 on this subject (*Journal*, vol. 51, p. 97) it was recommended that a day commencing at 0 hours midnight should be substituted for the astronomical day commencing at 0 hours noon in all nautical publications. We are informed by the Hydrographer that the recommendation has been adopted by the Admiralty, and that the necessary alterations will be made in the Nautical Almanac commencing in the issue for 1925. The change had already been arranged to take place in the Admiralty Tide Tables for 1920, and it will be introduced where necessary in any other nautical publications of the Hydrographic Department.

Diversity in Man.

In her paper read before the Society in May 1917 Miss Newbigin discussed the question of race and nationality and maintained that racial characters in man have long been playing a less and less important part. She has since, in a paper contributed to the *Geographical Review* for November 1918, approached a closely allied subject: "The Origin and Maintenance of Diversity in Man," from a somewhat different standpoint, and her remarks are as usual both instructive and suggestive. The paper is a welcome protest both against the tendency towards uniformity associated with advanced industrialism, which it was the aim of the authors of the late war to impose on mankind, and against the pessimistic view that it is useless to expect the desirable diversity to be long maintained under modern conditions. In insisting on the geographical significance of the subject she points to the case of Alsace and Lorraine, "regions with a strong localized life, deeply enshrined in the hearts of their people. All geographers at least should admit that that localized life, embodied in tradition but based ultimately upon place conditions, is part of the world's heritage, not to be lightly tampered with." Yet Germany's rule aimed at crushing out such local life—an attempt to stop the process of evolution as it occurs among modern men which was bound to meet with resistance. As in her previous paper, Miss Newbigin dwells on the different way in which animals and man are affected by causes tending to variation, largely due to the intelligence and nimbleness which in man's case render him independent of the natural barriers by which animals are separated. It is to the constantly present differences of physical environment that we must look for the maintenance of variety in man, and Miss Newbigin strenuously opposes the idea that modern means of intercommunication have rendered environment artificially uniform throughout the world. In contrast to the slow and indirect way in which varieties are produced in animals, she maintains that human societies have a speedy and direct capacity for adapting themselves to place-conditions, and at the same time a strong power of resistance to outside attack. Many of the characters often regarded as race-characters are, she thinks, merely examples of direct adaptive response to environmental conditions, as, e.g., in the case of the seafaring instincts of coast-dwellers, while the changed outlook acquired in the British colonies—even by those of strictly British lineage—is no doubt largely the effect of environment. Even if modern industrialism makes for uniformity, it must be remembered that it is but a form of "robber economy"—based on the using up of accumulated natural stores of wealth—and as such is likely to prove but temporary. With a careful utilization, not an exploitation,

of natural resources, we may hope to see a changed world, with new regional groupings and new forms of human diversity.

CORRESPONDENCE

Bantu Pronunciation

Native Commissioner's Office, Mwinilunga, Northern Rhodesia.

28 February 1919

I HAVE only just read your interesting article in the October number of the Society's *Journal*. On page 232 I notice that you say the sound of *Zh* (French *Ź*) is unknown in the Bantu languages. This is a misstatement, as in both the Alunda and Valuena dialects it is in frequent use—the hard English *Ź* is never heard when conversing with people of the above tribes; but doubtless your statement will have been corrected long before this letter reaches you.

Very truly yours,

F. V. BRUCE MILLER

(Native Commissioner).

We are glad to publish this correction to the statement in the October number; it was made on the authority of a letter from Sir Harry Johnston, to which we doubtless gave too general an interpretation.—ED. *G.Ź*.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1918-1919

Eleventh Evening Meeting, 28 April 1919.—Sir Francis Younghusband
in the Chair.

ELECTIONS.—Clifford Whiteley Collinson; Captain Charles William Dodson, B.A.; Commander Charles Burgess Fry, R.N.R.; Harold D. Holloway; Stephen Leech; Captain Ernest A. Loftus, B.Sc., L.C.P.; L. Phillips; Major B. W. Shilson, R.A.S.C., M.I.MECH.E., M.I.A.E.; Lieut. Cyril George Smith; Mrs. I. W. Sweetnam; Lieut.-Commander Lionel W. R. Tufnell Turbett.

PAPER: Southern Nejd. Mr. H. St. J. B. Philby.

Twelfth Evening Meeting, 12 May 1919.—The President in the Chair.

ELECTIONS.—Captain Henry Courtney Brocklehurst; Lieut. Thomas Ernest Dodds, R.E.; Rev. Arthur T. Fowler, M.A., PH.D., D.D.; Major Austin Barn Gillies, O.B.E.; Rev. John Goodchild, B.A.; Captain Henry A. A. F. Harman, D.S.O.; Commander George Robinson-Hudson, R.D., R.N.R., F.R.A.S., etc.; Richard Thomas Kearney, J.P., F.A.I.S.; Edward Dalrymple Laborde; Edgar B. Lambert; James McIvor Macleod; Thomas E. Marks; Clifford Montague; Miss Evelyn A. G. Mould; H. W. Nicholson, A.M.I.C.E., B.Sc.; Miss Emily L. Norris; C. Reeves Palmer; Vladimir Poliakoff; Felix B. Pratt; Captain R. Rose, R.F.A.; William Thomas, B.Sc.; Captain R. Tipple, A.I.N.A.; Miss Esther Parsons Tucker, LL.A.; Geoffrey James Hugh Thomas Turbett.

PAPER: Crete: its Scenery and Natural Features. Mr. A. Trevor Battye.





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